Installation
Operation
Maintenance

CCE (CCEB/CCEC)
Air Handling Unit

March 2021 AH-SVX01H-GB

TRANE TECHNOLOGIES

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

! 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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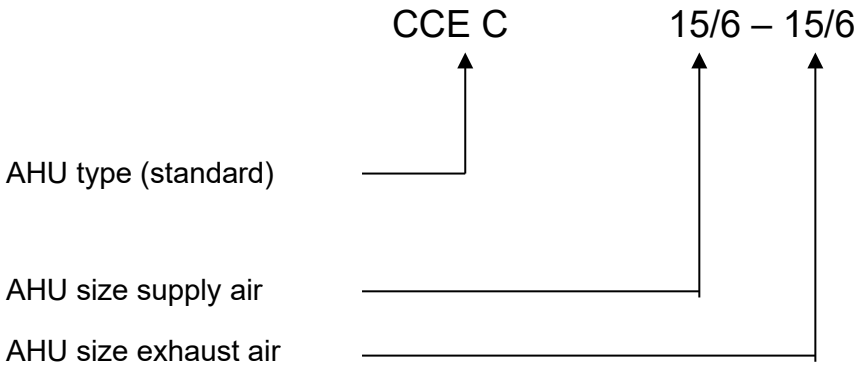
- Original Instructions -

1 Introduction

This is the instruction and operation manual for an air handling unit, hereinafter designated as 'AHU'.

1.1 Model code



Legend used for AHU type

CCE VISION	casing type with thermally decoupled version T2-TB1
CCE C	casing type with thermally decoupled version T2-TB2
CCE B	casing type version T3-TB2
CCE COMPACT	compact AHU series with thermally decoupled version T2-TB2
ETA XXX	key ETA: including control
ETA POOL	compact AHU for pool dehumidification with refrigeration circuit (option)
ETA PAC	indirect adiabatic cooling
ETA MATIC	control for AHUs

Design key AHU execution

S	AHU for indoor installation
DG	AHU for outdoor installation
I	AHU Industrial – heavy version of the panels
HG	AHU hygienic execution

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.

1.2 Intended use / foreseeable misuse

1.2.1 Intended use

The AHU is used, depending on the chosen purpose for
- transportation and conditioning of air in and out of buildings, in which humans stay
- creation of a desired room air quality in the occupied area of humans
- creation of an acceptable comfort or desired working conditions
- depending on the AHU type, the air conditioning is done primarily by
    - Air change
    - Control of air temperature and air humidity
    - Filtration of normal polluted air
    - 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, 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 operation at 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 of the series CCE B and CCE C, as described in this manual are designed, built and delivered according to customer requirements. Therefore, TRANE 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 TRANE, 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 TRANE. Therefore, a disclaimer applies for TRANE, 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 TRANE declines the responsibility, because the AHU is built according to the confirmed specifications.

Components provided by the customer
If it is planned and agreed, that TRANE installs components in the AHU, which are provided by the customer, TRANE 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.
For AHUs with components provided by the customer no CE-conformity is generated due to this reason.

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 TRANE, are the sole responsibility of the executing person, concerning functionality as well as safety aspects.

1.2.2 Foreseeable misuse

Other than above use, is considered as improper and must be excluded totally:
- The commissioning of equipment, prior to performing the steps indicated in the assembly instructions and operating with the fan section door open, is a serious security risk.
- Opening the AHU, without securing the main switch in the off position, represents a massive security risk.
- 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 an explosive atmosphere is prohibited, as long as the AHU is not executed in accordance with the ATEX directive. Application of AHUs in ATEX execution, see **chapter 11 (AHUs in ATEX execution)**.
- Handling of air with corrosive / aggressive components.
- Pressure-sided doors can detach suddenly while opening. So, there is a risk of injury for the user. See chapter **5.2 Doors.**

1.3 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 seen on the technical data sheet - see **chapter 1.4 (Documentation**).

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

1.4 Documentation

The AHU will be delivered with the following documentation:

Instruction manual CCE (This document is an extract of the complete instruction and operating manual and includes chapters 1 to 4.)	There is a cardboard box for 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:

Components operation manual	There is a cardboard box for loosely delivered parts inside of the AHU or can be downloaded from the homepage of the component manufacturers.
AHU drawing	applied on each delivery section
Wiring diagram for ETA	in control cabinet

Operation manual control ETA MATIC / ETA POOL	in control cabinet

Depending on type of accessories, the following documentation is included:

K-value for airflow measurement	There is a cardboard box for loosely delivered parts inside of the AHU.
Belt drive and tension data	There is a cardboard box for loosely delivered parts inside of the AHU.
Data point list	in control cabinet
Piping & instrumentation diagram	in control cabinet
Records for refrigeration circuit application	in control cabinet

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

You will also find stickers with warning 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

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 component manufacturer. In case of contradiction between this manual and instruction manuals of the component manufacturer for safety instructions, the most restrictive 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 TRANE office.

2 Safety instructions / Guidelines to conformity to laws and directives

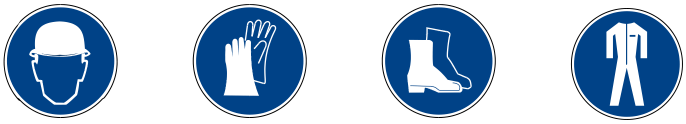
2.1 Indications for minimizing specific hazards

2.1.1 General indications

An improperly performed maintenance can pose a security risk!

Risk of thin sheets, when working on AHU

During work on AHU (or on parts), there is a substantial risk of cutting with thin sheets as e.g. roof sheets, fins of heat exchangers, corners and edges - Use personal protective equipment: wear protective helmet, gloves, safety shoes and long protective clothing.



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.

- If the AHU is part of the smoke extraction concept, then the specifications of this concept have to be observed.
- Otherwise, the power supply of the AHU must be interrupted 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

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:

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

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

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…
- all current-carrying 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 a re-activation during the work. The housing of the AHU interior lighting (can have separate supply) is not current-carrying.
- all moving parts, especially the fan wheel, motor and heat wheel have come to a standstill; wait at least 5 minutes after switching off 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 key from doors with door lock before entering in the casing of the AHU. Keep the key out of reach of unauthorized persons.
- Check that the hot media supply such as steam is interrupted and all the heat registers, heat exchangers, etc. are cooled to ambient temperature.

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 working and before the start that…

- nobody is in the AHU.
- all protective devices are working, (optional safety devices such as the door guard and belt 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

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

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

Prevention of exposure caused by antifreeze agents

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

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

Prevention of hazards caused by steam heaters or humidifiers

By hot steam there is a danger of burns. Therefore, make sure that no steam pressure is present and the system is cooled before working on the steam piping.

Avoid any type of ignition source when cleaning the humidifier and the associated components and circuits by means of descaling agent. With strong descaling agents, direct sunlight can already cause a fire.

Avoid body contact with descaling agents, as it can cause chemical burns and serious eye damage. When handling descaling agents, wear appropriate protective clothing (e.g. gloves, goggles, …) and ventilate the room well.

Prevention of hazards caused by suddenly falling out door panels while opening of removable panels

Removable door panels can fall out after detaching the connections and lead to injuries. Particular care should be taken when removing pressure sided doors because they can be firmly in place then suddenly detach. 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.

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

2.1.2 Refrigeration circuit

Preventing the risk of exceeding the maximum operating pressures PS

Never exceed the maximum operating pressures PS, which are specified on the type plate (even not for test purposes). Damage may limit the security and lifetime of the system. Never operate the refrigeration system with a closed discharge line valve.

Risk of burns on hot surfaces

On the compressor casing, pipelines and circuit components and on the oil sump heater surface temperatures of far higher than 100 °C may occur, which may cause serious injuries. Wear the required personal protective equipment (protective goggles, gloves, etc.).

Prevention of risks due to contact with refrigerant

Physical contact with refrigerant must be strictly avoided as it can cause severe frostbite and damage the retina - temperature range, for example R407C **at ambient pressure** is approximately **– 44 °C**!

Prevent the risk of suffocation

Safety refrigerants are odorless, tasteless and can contaminate the air and cause suffocation (MAK - value 1000 ppm).

- In case of refrigerant leaks, immediately leave the affected room. Enter only with breathing protection and ensure adequate ventilation.
- Refrigerant is heavier than air and will collect at the lowest room point. For small refrigerant charges, this risk is significantly reduced.
- Refrigerant and compressor oil react as soon as they come into touch with open flame toxic substances. Do not inhale!
- Do not smoke in the technical room!
- For more information refer to **chapter 8.2.3 (Refrigerant)**.

2.1.3 ATEX AHUs

If instructions differ, the ATEX-specific instructions must be given priority. In addition to the actions mentioned here, the instructions according to **chapter 11 (AHUs in ATEX execution)** have to be observed.

General safety indications

Hazardous areas must be rated on the frequency and duration of the occurrence of hazardous explosive atmospheres (gas / air or steam / air mixtures and / or dust / air mixtures). This is described in Directive 1999/92/EC. Because of this zoning an adapt AHU must be used. The relationship between zones and category as per **Table 21 (chapter 11.4 (Ignition temperature and temperature classes))** described.

ATEX AHUs may not be used near:

- High frequency sources (e.g. transmitter systems)
- Strong light sources (e.g. laser beam systems)
- Ionizing radiation sources (e.g. X-ray machine)
- Ultrasound sources (e.g. ultrasound echo testing equipment)

Safety indications for operation

The following instructions must be observed urgently for the safe operation of ATEX AHUs:

- Operating conditions in accordance to the intended use.
- In the immediate environment of the AHU there should be no substances according to EN 1127-1:2019-10, which are prone to spontaneous combustion, such as pyrophoric substances.
- Permanent and adequate ventilation of the installation room to prevent the creation of an explosive atmosphere, which is caused by leakage.
- Do not exceed 80 % of the maximum permitted speed of the fan, as it could otherwise lead to sparking and damage.
- Appropriate measures must be taken against all types of ignition sources that are not specific to the AHU and are not included in the TRANE scope of delivery.

Safety indications for maintenance and repair work

In addition to the safety instructions in **chapter 2.1 (Indications for minimizing specific hazards)** and in **chapter 2.5 (Staff selection and qualification)**, the following special safety instructions must be observed:

- Work may only be performed within a non-explosive atmosphere.
- The creation of an explosive atmosphere needs to be counteracted by adequate ventilation.
- If necessary, it could be also required to flush the system with fresh air, in order to remove or dilute an explosive atmosphere.
- When the system is at a standstill, the concentration of the atmosphere can change and thus increase the risk of explosion. Therefore, all types of ignition sources must be avoided during maintenance. If necessary, it may be required to carry out a clearance measurement with a gas detector before starting work and during work.
- Work may only be carried out if there are no zones or ignition sources are avoided. It is particularly important to ensure that all work equipment is approved for the corresponding zone (see EN 1127-1 appendix A and TRBS 2152).
- Use only suitable tools according to EN 1127-1:2019-10 to prevent sparking.
- Perform work only with conductive footwear (according to BGR 132) in order to avoid electrostatic charging.
- To prevent the formation of explosive atmospheres by whirling up dust deposits, all internal and external device surfaces must be continuously cleaned.
- To avoid static charging, cleaning work may only be performed with a wet cloth.

2.2 CE-conformity / installation instructions for safe operation

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

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

The AHU is always only a part of the building system and requires supplements on-site, that means in responsibility of the customer. Therefore, for a **safe operation**, the general in **chapter 2.2.2 (Installation instructions for the proper installation in the building system)** and in particular in the following chapters described on-site work must be carried out exactly before the initial start-up. The AHU must be mounted and operated professionally, according to the specifications in

this operation 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 and operation 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 TRANE, the AHU complies with the fundamental health and safety requirements of the EC Machinery Directive 2006/42/EC.

TRANE 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 TRANE 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 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

2.2.2 Installation instructions for the proper installation in the building system

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 drawing supplied on the inner face of fan section door. 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 persons accessing from the outside to moving parts (such as fan wheels) during operation.

Main switch
See **chapter 7.3 (EC motors**).

Installation of ceiling AHUS – flat AHUs
See **chapter 4.2.4 (Special guidelines for flat AHUs – ceiling AHUs)**.

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 1.2.1 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
As a basis for on-site sound measures calculation (such as for sound attenuators) the on request available sound data can be used. 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 4.2.2 (Actions to prevent potential risks).**

Motor connection
See **chapter 7.2 (AC motors)**.

Frequency controller for Plug fans
Also, if not supplied by TRANE, a frequency converter must be installed to reach the calculated operating point. For details see **chapter 7.5 (Variable, frequency-controlled drives (VFD, frequency converters))**.

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 TRANE) and connection of thermostats for safety shutdown, see **chapter 7.6 (Electric heaters)**.

Plate heat exchanger
Installation (if not supplied by TRANE) and connection of differential pressure switches to protect the plate heat exchanger from damage in **chapter 7.7 (Differential pressure restriction for plate heat exchangers)**.

Siphons
Connecting according to **chapter 6.3 (Drain for condensate and excess water)**.

Dampers with external gear wheels
According to **chapter 5.5 (Dampers with external gear wheels).**

Flexible connection
Installations (if not supplied by TRANE) refer to **chapter 6.4 (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, aqueous vapor, refrigerant ...), 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
On site mounted field devices for roof AHUs, e.g. damper position motors or pressure switches must be weather-protected in case of insufficient IP class and - depending on the installation situation - possibly also protected against icing.

Freeze protection

The customer must ensure sufficient freeze protection measures. See indications in **chapters 4.2.1 (Potential risks that may arise at the erection site), 4.2.2 (Actions to prevent potential risks)**, 6.6 **(Freeze protection measures)** and **7.8 (Frost protection for plate heat exchanger)**.

Venting, draining of heat exchangers
See chapter **8.1.3** (**Heat exchanger**).

2.3 Conformity to laws and directives

2.3.1 General

The AHU will be built and delivered according to the agreed specifications and exactly to your requirements. It is important to note that the AHU is a part of a system and that the AHU is only after assembling and connection to the system ready for operation. It is normal, that the AHU is ready for operation only after installation-work.
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 obligated – 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.

2.4 ErP conformity according to directive (EU) 1253/2014

The ErP directive (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)**. Or in the special **chapter 7.5 (variable, frequency-controlled drives (VFD, frequency converters)).**

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 controlling. They will be triggered if the pressure drop at the filter exceeds the maximum permissible value. See **chapter 9.3 (air filters).**

If above mentioned equipment is not included in delivery by TRANE, it has to be provided 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 may 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 recognize 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.

Work on optionally installed refrigeration components must be performed only by trained technicians and according to commission implementing regulation (EU) Nr. 2015/2067 certified refrigeration technicians.

Subsequently, warning triangles indicate warnings 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

Note: **Chapter 3.2 (Lifting by forklift / lift truck)**, **chapter 3.4 (**Overlifting of AHU sections with crane lugs**)** and **chapter 3.5 (Overlifting of monoblocs)** do not apply to flat AHUs (ceiling AHUs), since they are not equipped with base frame.

3.1 Reception control

- Upon arrival of the equipment, please check immediately the package for completeness and any damage.
- Loose supplied parts and assembly materials are in a nylon bag or a box in the AHU.
- If damages are found, immediately complete a damage report and send it to TRANE. Only then the transport company can make the claim with the insurer (Note 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 recognized, if procedures are not followed. In case of complaints please inform immediately the TRANE office.
- Depending on the material used and the environmental conditions, a superficial corrosion may occur on components like e.g. motor shafts, fan shafts, pulleys, clamping bushes, sheet cutting edges, and so forth. The resulting corrosion layer protects the underlying material from further corroding and does not represent a defect of the component or the device (see also **chapter 9**).

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

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

If climbing on the AHU is unavoidable during assembly, for example, for connecting the roof plates, it must be ensured by appropriate measures. For example, using boards, that the weight is distributed evenly, in order to avoid bending of the roof panels.

Devices shall not be climbed. If unavoidable: weight must be compensated by use of boards.

Figure 1: Do not climb on the AHU!

Differentiation of delivery
For unloading, transporting and lifting an AHU to its final installation location, two fundamentally different forms of delivery are to be differentiated.

The delivery form is agreed with the customer in the order clarification and can be:

1) Supplied in parts

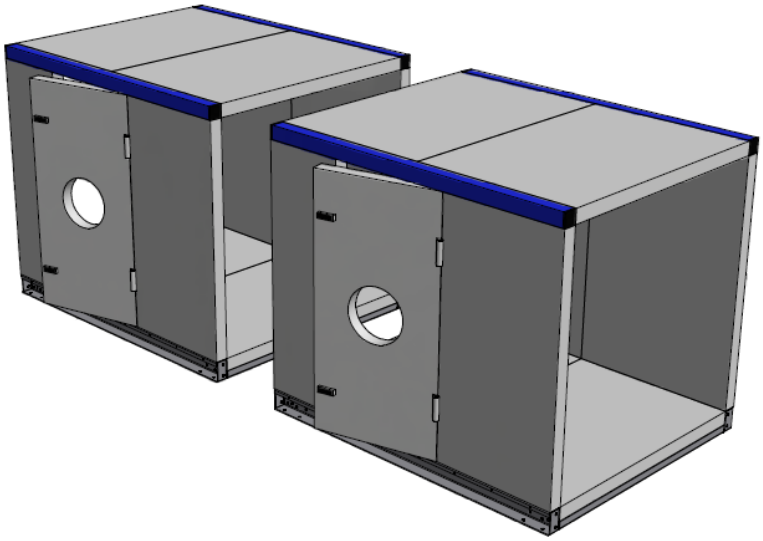


Figure 2: Delivery in parts

- Delivery in parts allow the supply of major equipment in small sections and provides more easily insertable parts.
- Sections have a base frame, on which on each corner a (supplied) crane lug can be attached.
- Size and weight of the sections are indicated on the AHU drawing, see **Figure 9**.

2) Supplied as monobloc

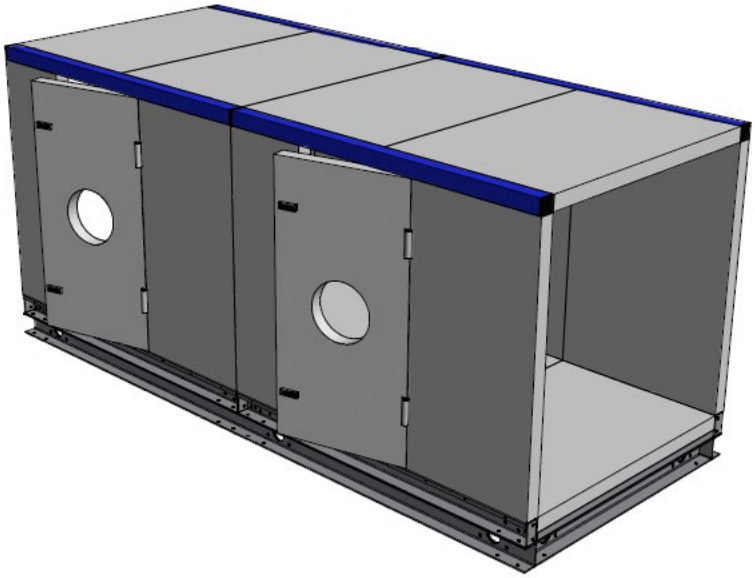


Figure 3: Delivery as monobloc

- The delivery of a whole AHU in one piece is called monobloc.
- If the space conditions allow the delivery of a monobloc, then the assembly at the installation location is much faster.
- Monobloc AHUs have an additional counter-frame on which the components are already pre-assembled.
- The counter-frame is provided with holes diameter 50 mm, which can be used for the overlifting, see **chapter 3.5 (Overlifting of monoblocs)**.
- Size and weight of the monobloc is specified on the AHU drawing and have to be considered for the determination of the load carrying equipment and hoists, see **chapter 3.5.1 (Weight details for monoblocs)**.

3.2 Lifting by forklift / lift truck

In accordance with the TRANE 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 4**.

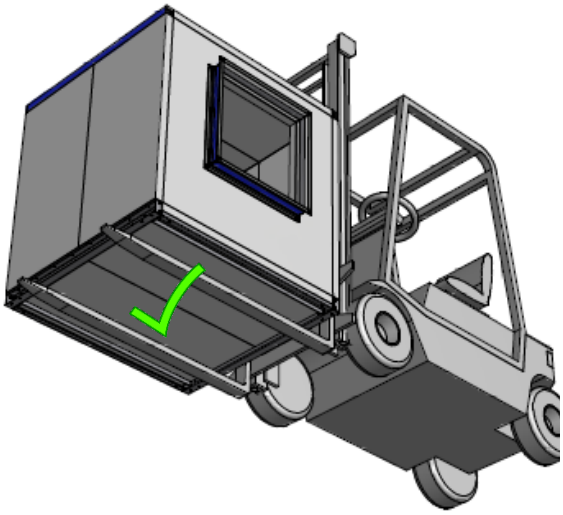


Figure 4: Transport correct

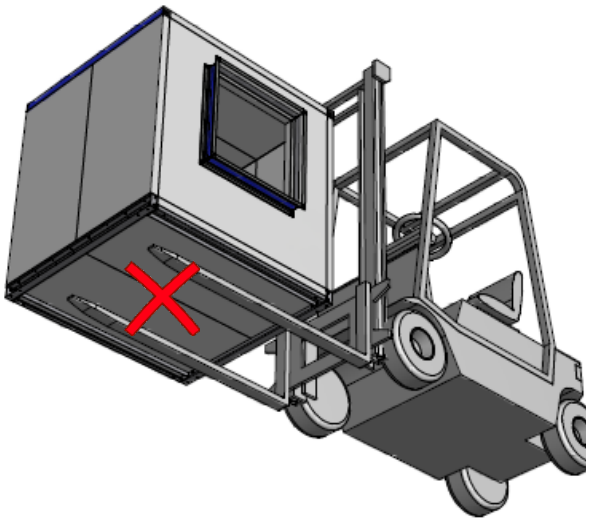


Figure 5: Transport incorrect

Center of gravity must be centrally located between the forks (see **Figure 6**). For large parts use several lift trucks.

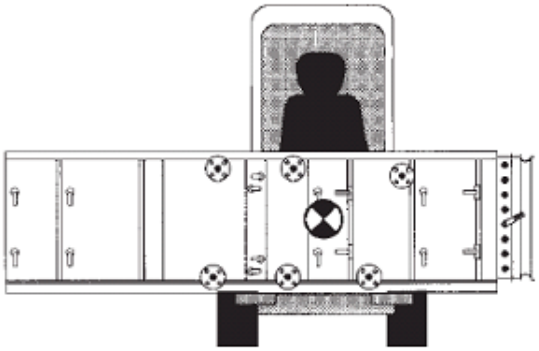


Figure 6: Center of gravity centrally between the forks

For the overlifting directly by crane from the truck applies the following **chapter 3.4 (Overlifting of AHU sections with crane lugs)** for AHU sections or **chapter 3.5 (Overlifting of monoblocs)** for monoblocs.

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.
- The AHU sections or monoblocs must be lifted with appropriate equipment e.g. belt with hook.
- The ropes, hooks and crane lugs used must be suitable for the load, see **chapter 3.4.1 (Control of weight limits of delivery sections)**.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 means must allow a favourable 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 7**.
- The course of the load carrying equipment must be chosen so that overhanging attachments, roofs and the like will not be stressed or damaged.
- Load carrying equipment shall not run over sharp edges and is not allowed to be knotted.
- The load carrying equipment must be secured against slipping off.
- Before lifting, check the screw connections of the crane lugs and the correct assembly as described in **chapter 3.4.3 (Mounting of base frame 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 further lifting, check by visual inspection that no conspicuous deformations can be detected on the suspension means.
- Avoid jerky lifting.
- Never lift AHU sections or monoblocs on heat exchanger connections or other attachments.

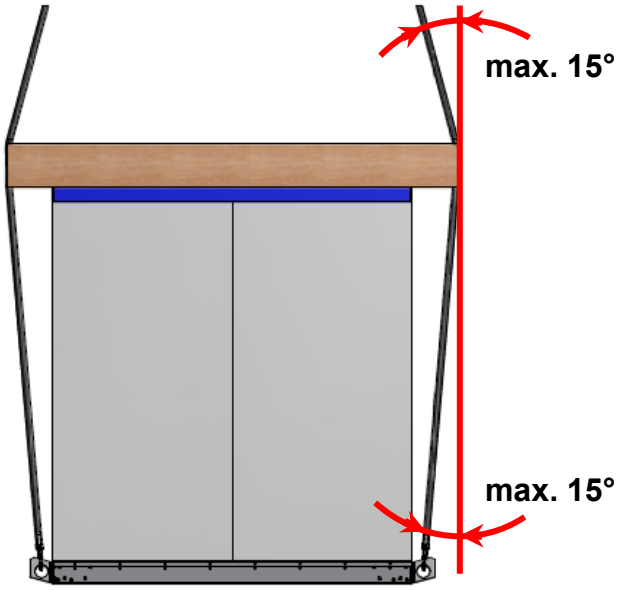


Figure 7: Permitted angle for load carrying equipment guidance

3.4 Overlifting of AHU sections with crane lugs

Chapter 3.3 is only valid for the delivery form **“Delivery in parts (delivery sections)”**.
For overlifting of AHUs delivered as “Monobloc”, see **chapter 3.5**.

- In addition to the actions mentioned here, the instructions according to **chapter 3.3 (Further necessary actions for the overlifting of both, delivery sections on crane lugs as well as monoblocs)** have to be observed.
- Parts of the AHU may only be lifted with lugs individually - never bolt parts together before lifting.

The lifting of monoblocs by crane lugs is permitted only in exceptional circumstances and requires the **written approval** by TRANE.

3.4.1 Control of weight limits of delivery sections

Depending on the base frame height (see **Figure 8**), delivery sections may be lifted with lifting lugs up to the following weight, refer to **Table 1**.

Base frame height H (mm)	Max. section weight (kg)
80	1.500
100	1.500
200	4.000

Table 1: Maximum AHU part weights for lifting by crane lugs

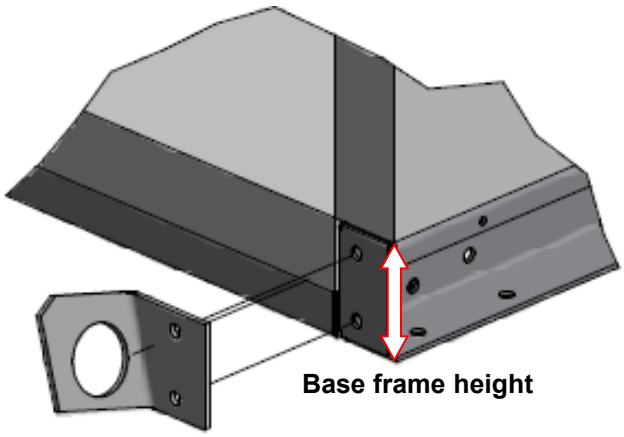


Figure 8: Base frame height

The weight of single delivery sections is shown in the attached drawing (on each delivery section). The delivery sections are marked with L1, L2, L3, ... on the drawing and with the same number on the section itself. Example, refer to **Figure 9**: Delivery section L5 = 601 kg

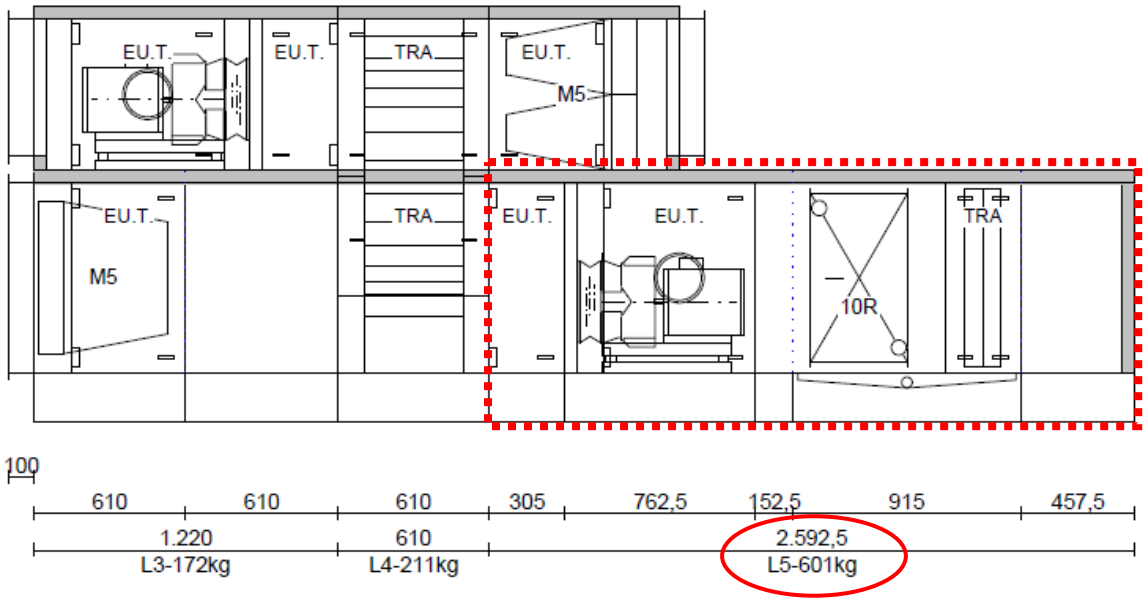


Figure 9: AHU section drawing with weight details

3.4.2 Necessary actions before lifting delivery sections with crane lugs

Opening accessories such as dampers, flexible connections, hoods, etc. must be removed before lifting, see the **following examples**. This equipment must be lifted separately on a pallet and then be reinstalled.

Example 1:

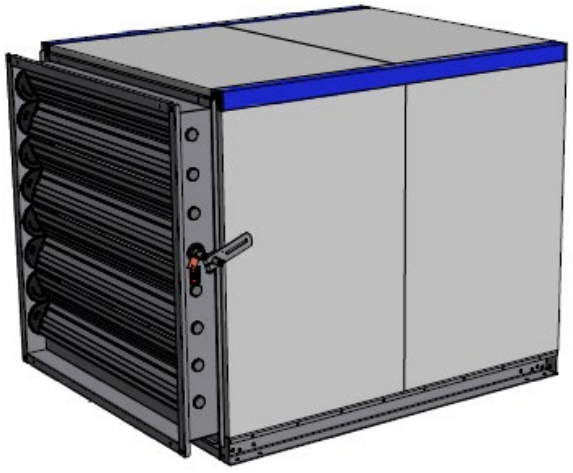


Figure 10: Delivery section with mounted damper

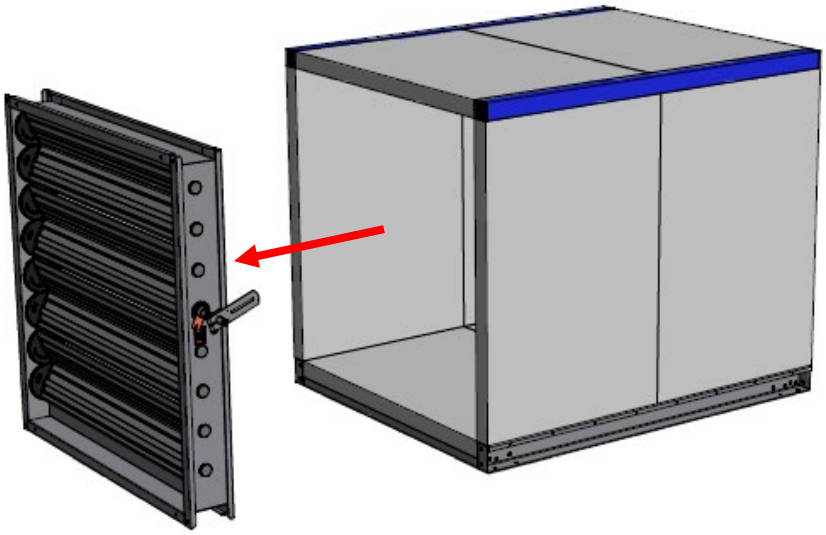


Figure 11: Delivery section with dismounted damper

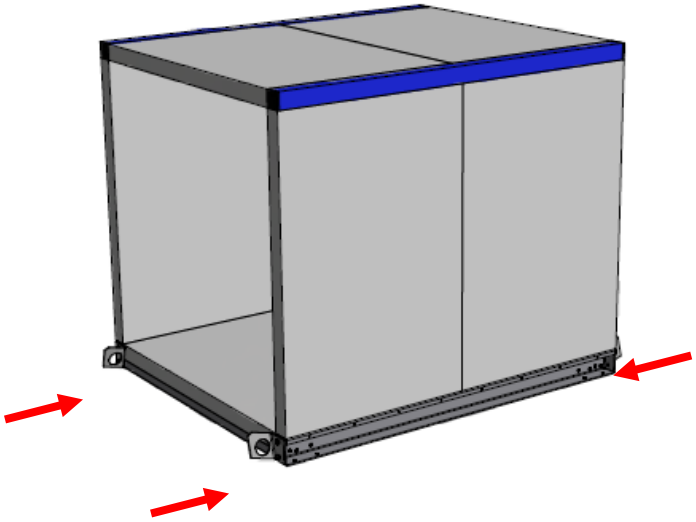


Figure 12: Delivery section with mounted crane lugs

Example 2:

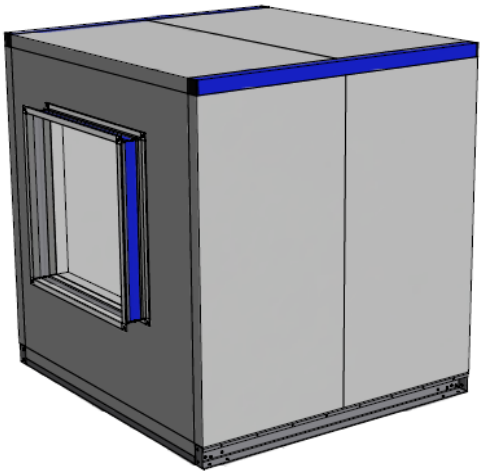


Figure 13: Delivery section with mounted flexible connection

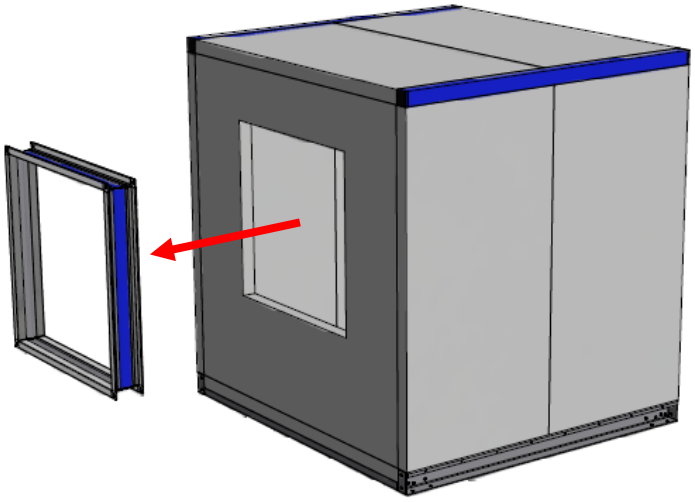


Figure 14: Delivery section with dismounted flexible connection

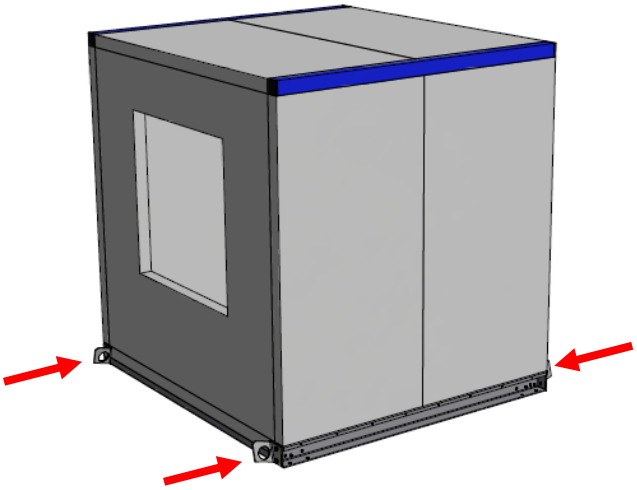


Figure 15: Delivery section with mounted crane lugs

3.4.3 Mounting of base frame crane lugs

For mounting crane lugs on AHU casing sections when plate heat exchanger and heat wheel parts are delivered disassembled see **chapter 3.6.2 (Lifting of heat wheel or** plate heat exchanger**).**

Base frame crane lugs are supplied in two versions and will be attached on the front side of the respective delivery section in accordance with the necessary preparations, described in **chapter 3.4.2 (Necessary actions before lifting delivery sections with crane lugs**).
Execution of the lifting lugs (see **Figure 16**):

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

Attention to correct mounting of the base frame crane lug according Figure 17:

- blunt corner has to point upwards
- bending edge has to point toward the center of gravity of the section

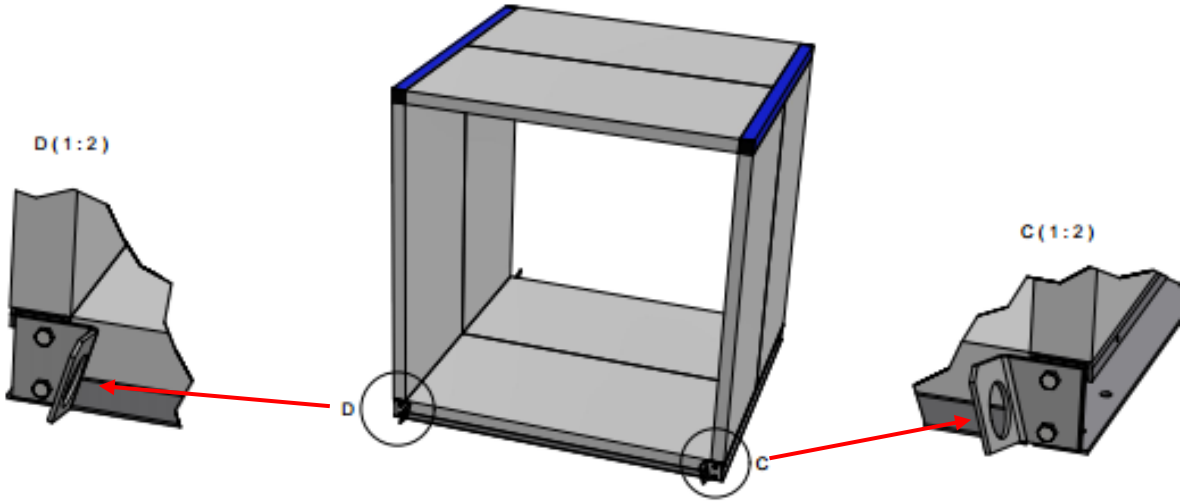


Figure 16: Left-side type and right-side type of crane lugs

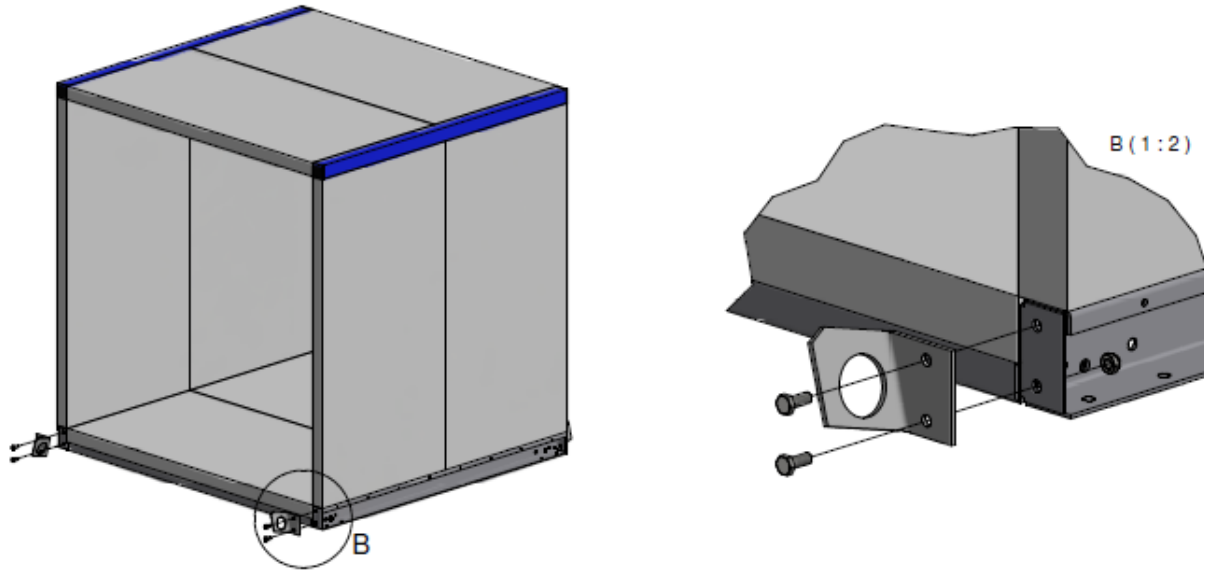


Figure 17: Mounting of base frame crane lugs

Bolts and nuts are delivered with the lifting lugs and must be tightened with the torque according to **Table 2.** If the lifting lugs are already mounted by TRANE, the screws must be checked before lifting of the AHU.

Base frame height H (mm)	Screw type	Nm	Strength class
80	M8x20	10	min. 8.8
100	M8x20	10	min. 8.8
200	M12x30	30	min. 8.8

Table 2: Tightening torque for screws

3.4.4 Lifting by crane lugs

- The load carrying equipment must not run over the operating side of the AHU, but it must run over the opening or the front side of the AHU (**Figure 18**).
- The force effect has to take place uniformly across all four crane lugs of a delivery section.
- After the pre-positioning of the delivery section at the desired position, remove the lifting lugs and use them for the next delivery section.

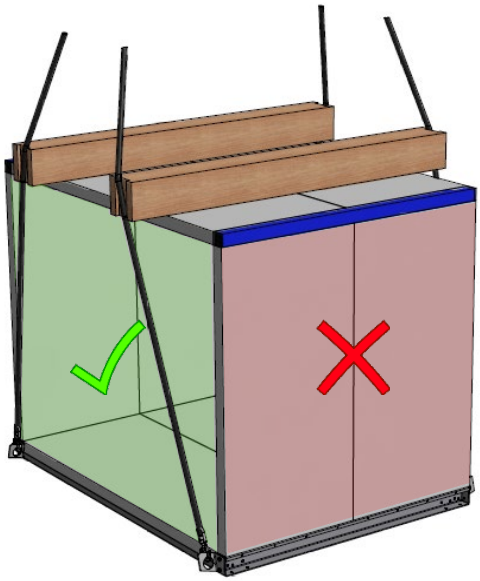


Figure 18: Load carrying equipment guided over front side

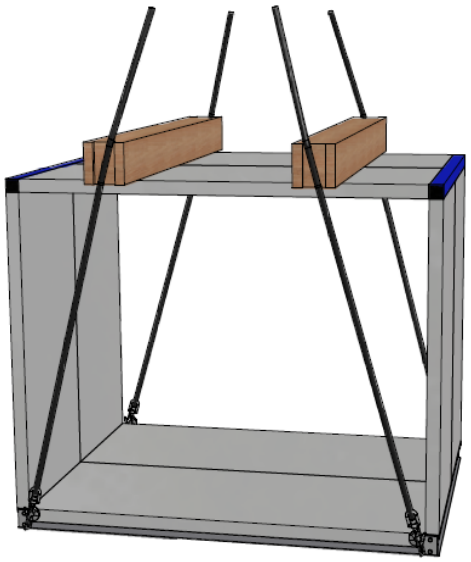


Figure 19: Uniform force effect

3.5 Overlifting of monoblocs

If several sections or the entire AHU is combined into one delivery unit, then this is called a monobloc. **Chapter 3.5 (Overlifting of monoblocs)** is only valid for the delivery form “Monobloc”. For overlifting of AHUs delivered as “Delivery in individual parts (delivery sections)”, see **chapter 3.4 (Overlifting of AHU sections with crane lugs).**

In addition to the actions mentioned in this chapter, the actions according to **chapter 3.3 (Further necessary actions for the overlifting of both, delivery sections on crane lugs as well as monoblocs)** have to be performed.

3.5.1 Weight details for monoblocs

The weight of the monobloc is specified on the AHU drawing. This weight must be considered at choosing appropriate transportation means.

3.5.2 Lifting of monoblocs

- Monoblocs are generally delivered with a perforated counter-frame – hole diameter 50 mm – for inserting suitable tubes/rods, where the AHU is lifted, see **Figure 20** and **Figure 21**.
- The tubes/rods are not included in the delivery scope, but have to be provided by the company, which is responsible for the lifting operation.
- Two, three or more holes per side of the monobloc are available according to the length and weight of the AHU. As a consequence, two or more tubes/rods can be used.
- The determination of the number and the dimensions of the tubes/rods and the load carrying equipment are the responsibility of the performing company.
- We recommend verifying the suitability of the selected tubes/rods by a structural engineer.
- The force effect has to take place uniformly across all tubes/rods.
- The load carrying equipment must be secured to prevent slipping off, e.g. see **Figure 22**.

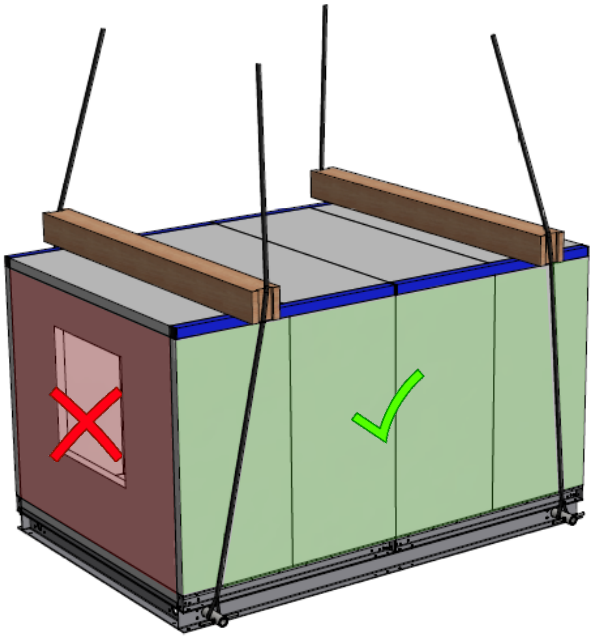


Figure 20: Guiding of load carrying equipment (monobloc)

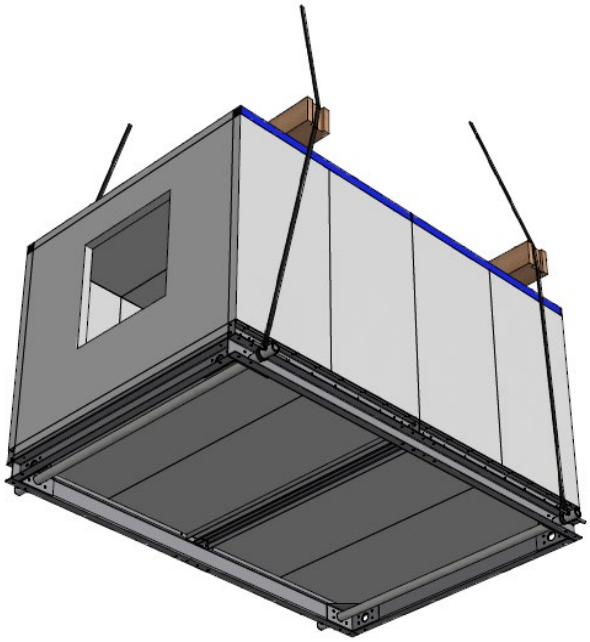


Figure 21: Uniform load of the form tubes

Figure 22: Securing against slipping off of the load carrying equipment

Lifting with monobloc crane lifting lugs

- In the counter frame are drilling holes for mounting monobloc crane lifting lugs with bolt connections. The bolts are mounted already by TRANE, if this option is agreed. (**Figure 23**).
- The crane lugs are included in the scope of delivery of TRANE, if the lifting of the monobloc by monobloc crane lugs is agreed.
- In accordance with the length and the weight of the monobloc AHU 2, 3 or more crane lifting lugs have be mounted at each side of the AHU.
- The weight must be applied evenly over all monobloc crane lugs.
- Dismount the crane lugs after pre-positioning of the AHU.

Figure 23: Factory-made preparation for monobloc lifting lugs

-

Figure 24: Positioning of the monobloc crane lifting lug at the counter frame

Figure 25: Fixing of the metal sheet and the monobloc crane lifting lug with nuts

Figure 26: Monobloc crane lifting lugs mounted

The lifting of monoblocs is just permitted for the case described above, with the particular crane lugs delivered by TRANE.

3.6 Lifting when heat wheel or plate heat exchanger casing is delivered in parts

According to the agreed AHU drawing, the casing of the heat wheel or plate heat exchanger section is delivered disassembled.

3.6.1 Assembly order of disassembled delivered casing parts

The following instructions and order must be observed when lifting or assembling the crane lugs of these casing parts (see also **Figure 27**):

1. Lifting of the bottom casing part: only base frame crane lugs are allowed be assembled on the bottom casing part (see **chapter 3.4.3 (Mounting of base frame crane lugs)**).
2. Lifting of heat wheel or plate heat exchanger: for assembling the crane lugs supplied by the supplier and for lifting the heat wheel or plate heat exchanger, the lifting instructions and specifications of the respective manufacturer must be observed. When positioning the heat wheel or plate heat exchanger in the bottom casing part, ensure that it fits exactly on the profiles provided for this purpose. This applies particularly if the heat wheel or plate heat exchanger has been delivered in several individual parts. Regarding the lifting procedure, see also **chapter 3.6.2 (Lifting of heat wheel or plate heat exchanger)).**
3. Lifting of the top casing part: on the top casing part use the supplied flat crane lugs (see **chapter 3.6.3 (Assembly of flat crane lugs)**).

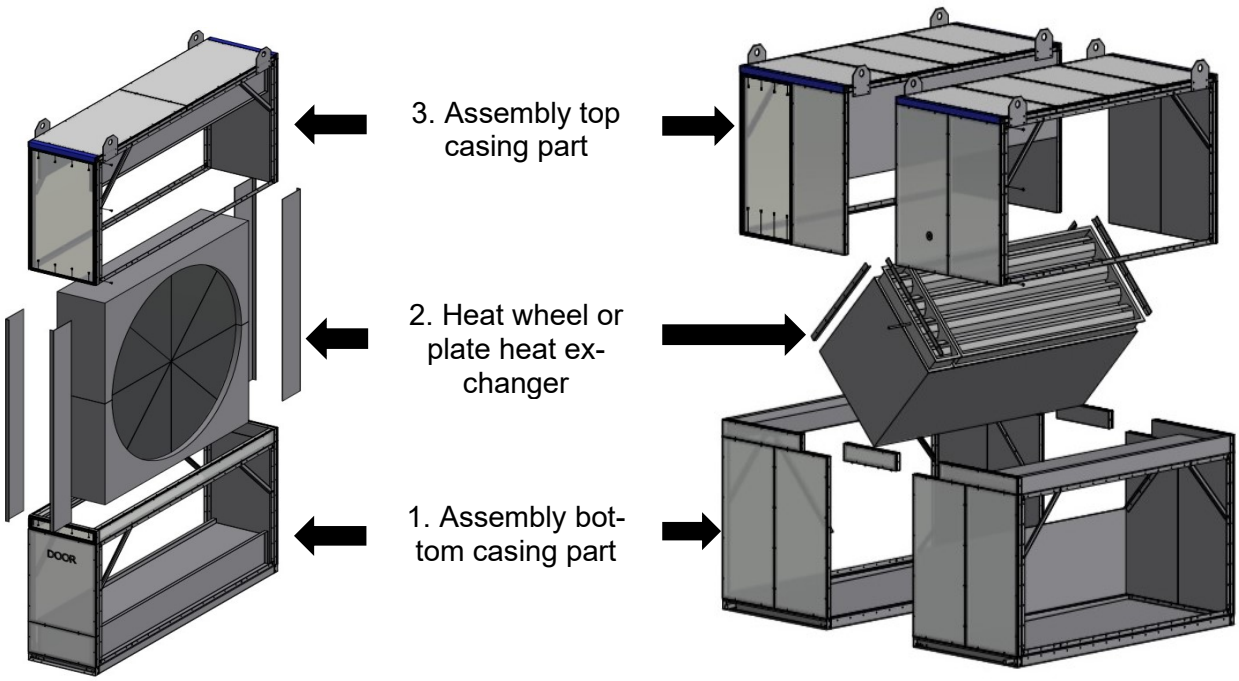


Figure 27: Assembly order of disassembled heat wheel or plate heat exchanger casing section

3.6.2 Lifting of heat wheel or plate heat exchanger

In general, when lifting plate heat exchanger, it must be ensured, that the lifting accessories are aligned vertically. See **Figure 28**.

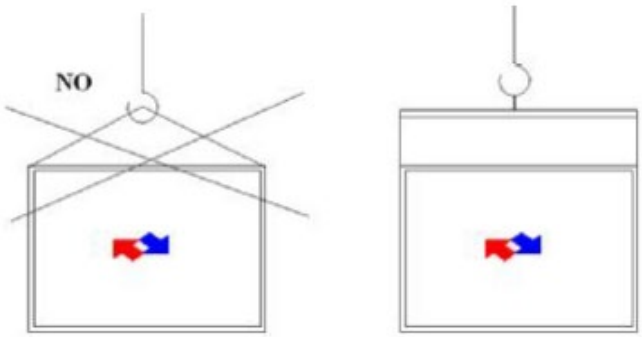


Figure 28: Correct alignment of the lifting accessories when lifting plate heat exchangers

3.6.3 Assembly of flat crane lugs

4 flat crane lugs are supplied loose. These lugs must be assembled as shown in **Figure 30** at the **top casing part** of the AHU.

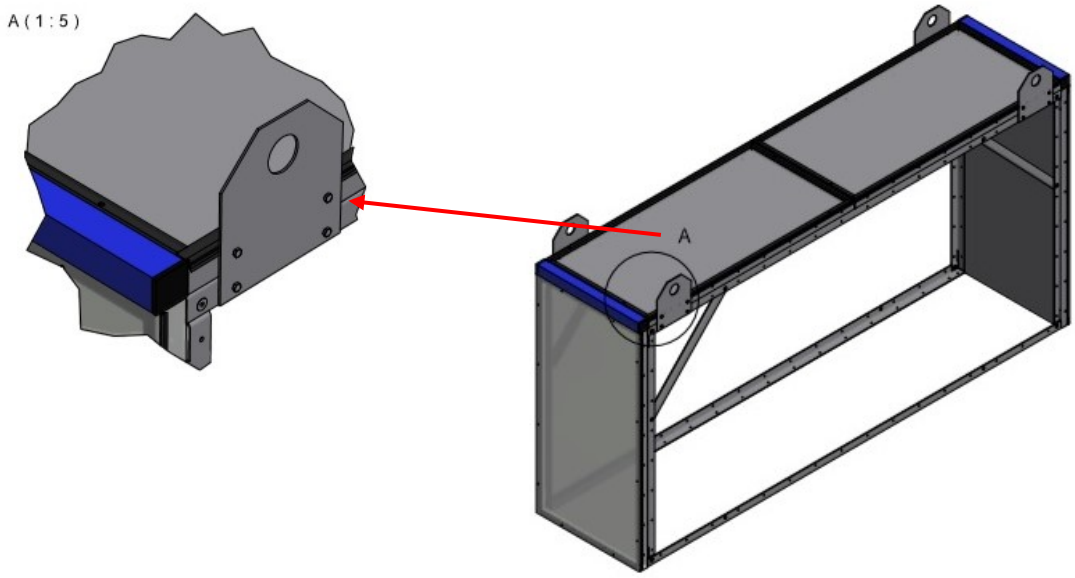


Figure 29: Flat crane lugs

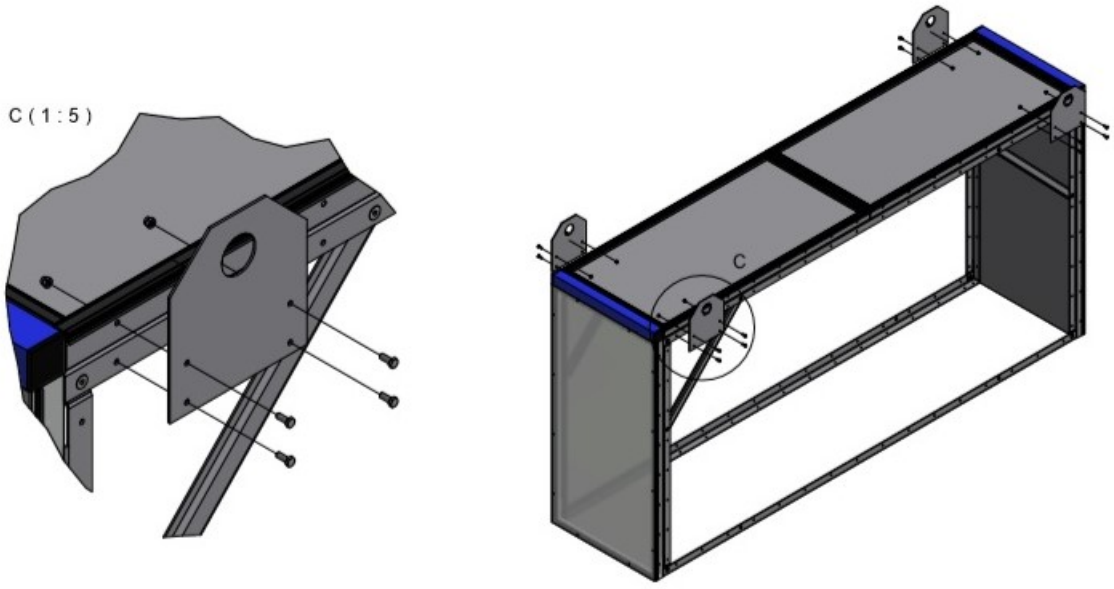


Figure 30: Assembly of flat crane lugs

Bolts and nuts are delivered with the lifting lugs and must be tightened with the torque according to **Table 3**. If the lifting lugs are already mounted by TRANE, the bolts must be checked before lifting of the AHU.

		
Bolt type	**Nm**	**Strength class**
M6x16	7-8	min. 8.8

Table 3: Tightening torque for bolts

ATTENTION on correct assembly of the flat crane lugs: The flat crane lugs must only be used to lift the top parts of the casing when the heat wheel or plate heat exchanger casing is delivered in parts, as shown in **Figure 30**. The use of the flat

crane lugs on all other AHU parts, in particular the lifting of an independent casing part including mounting parts is **not permitted**, see also **Figure 31!**

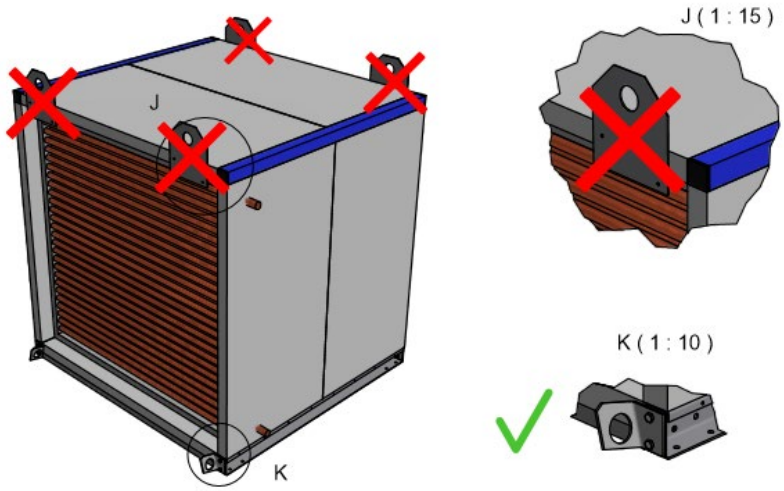


Figure 31: Impermissible assembly of crane lugs

3.7 Storage

The delivery sections generally are packed in nylon. This package is suitable to protect the AHU during loading and unloading from bad weather, but not for outdoor storage. The insertion into a dry area after unloading is therefore essential for the preservation of the AHU.

Standstill maintenance

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

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 may be formed within a short time on galvanized surfaces. It can further arise that an excessively high temperature is created under the packaging, which can also cause damages to the components.

If
you want to please to yourself, the planner, the owner and other observers of the AHU,
then
we strongly recommend covering and protect the AHU against dirt and damage during the installation and commissioning process, see **Figure 32**.

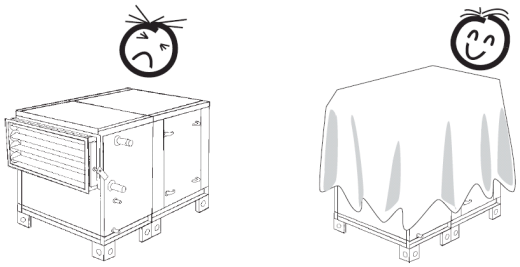


Figure 32: Protection against dirt

4 Foundation / erection

Space requirements:
At the location, proper maintenance and the removability of build in components shall be physically possible. Therefore, a free working space of AHU width + 300 mm shall be available. On the back site for mounting a 600 mm width passage should remain free.

According to EN 13053 and VDI 3803 it is not permitted, that the bottom of the AHU replaces the building roof. Furthermore, it is not permitted that the AHU substitutes any part of the building.

4.1 Foundation

Recommended are solid foundations of reinforced concrete, as shown in **Figure 33** left, or strip foundations, as shown in **Figure 33** right. For strip foundations, concrete or steel beams shall be used, see **Figure 33** bottom-right. Steel beams constructions must have an appropriate stiffness in relation to the AHU size. The foundation must be flat and leveled, it may not have fall in any direction or uneven surfaces.

AHUs have to strain via baseframe in longitudinal direction and cross direction optionally in form of strips or point like the foundation. The distance of the strip or point contact surfaces **must not exceed 1,500 mm** in length and width of the AHU.

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 complying the conditions must be taken (e.g. distance sheets with appropriate thickness).

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

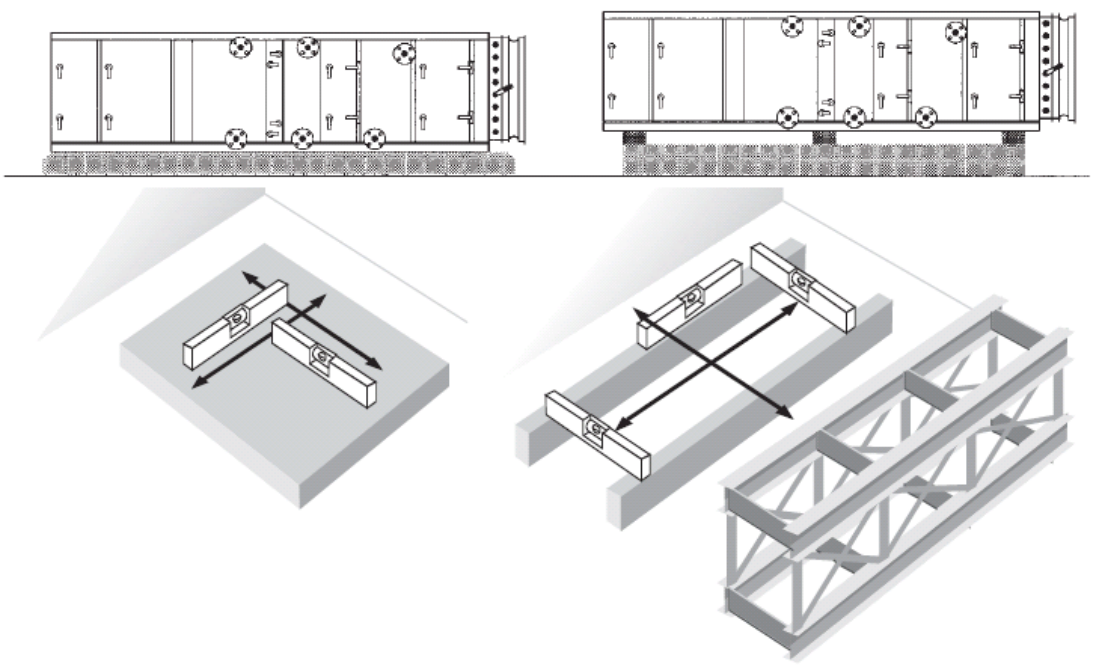


Figure 33: Solid foundation and strip foundation

The installation of underlayment 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 used absorbent material must be adjusted to the load to achieve optimum noise insulation. Each contact point between AHU and foundation must be noise insulated. Additionally, the respective design criteria of the manufacturer must be complied. For the weight specifications of the AHU see the technical data sheet.

4.2 Erection

4.2.1 Potential risks that may arise at the erection site

- For heating or cooling water, water-glycol circuits or steam lines for heating or cooling these can be connected to the AHU. There may also be internal (closed) water or water-glycol circuits. In addition, a humidifier with inlets, outlets, overflows may be installed for humidification.
- The pipes or hoses and their fittings can become leaky or loose, so that inside or outside of the AHU water or the medium exits.
- Cooling processes can cause dehumidification and the associated formation of condensation in the AHU. The AHU is then equipped with condensate collecting trays and outlets. Nevertheless, condensate can exit from the AHU in case of errors on the AHU, under inadmissible or extreme operating conditions. Errors on the AHU, inadmissible or extreme operating conditions can also cause the formation of condensate on the outer surfaces of the AHU, which may then drip down.
- Internal and external cleaning - also wet cleaning - can be performed on the AHU. When performing this work, an exit/dripping down 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:
    - Condensate pans of heat recovery systems and heat exchangers inclusive pan nozzles, siphons and drains
    - Freezing condensate directly on the heat recovery system and heat exchanger

- Freezing operation fluid of heat exchangers with/without glycol
- Humidifier section (spray humidifier and honeycomb humidifiers are not applicable for outside AHUs)
- All areas and parts of the AHU which are exposed to the weather.

4.2.2 Actions to prevent potential risks

These risks can be prevented by the following actions:

- It does not matter, whether or not the AHU is floor standing, heightened (e.g. on a scaffold) or suspended from the ceiling, the easy assembling and maintenance of the AHU has always to be guaranteed on site
- Depending on the erection, suitable protective actions must be taken to ensure that persons, buildings and equipment are not jeopardized by falling parts (e.g. tools, screws, etc.) and possible exit of water or other fluids.
- The ground around the erection site should be watertight and have with a downward gradient to a sufficiently sized outlet.
- Where this is not met, the erection of the AHU in a sufficiently sized collecting tray with an outlet may be an appropriate solution.
- A humidity sensor with alarm transmitter can represent an additional action to protect critical operating conditions.
- For AHUs suspended from the ceiling, it is recommended in any case to provide a sufficiently dimensioned collecting tray with outlet under the AHU.
- To avoid freezing of components, the customer must ensure, that the AHU is protected against weather, which could lead to such problems. Additionally, the customer must take further measures to provide freeze protection. Some possibilities for that purpose are:
    - Complete drainage of the heat exchanger if it is not used
    - Usage of water/glycol mixtures with adequate glycol concentration as fluid for the heat exchanger. (Attention: Performance loss must be considered)
    - Control-technological frost protection

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

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

4.2.3 General indications for the erection

If floor AHUs shall be mounted on the ceiling, then the device must be fixed with the base frame on an encompassing suspension see **Figure 34** right. The handling of the structure-borne noise insulation is analogously as for floor AHUs.

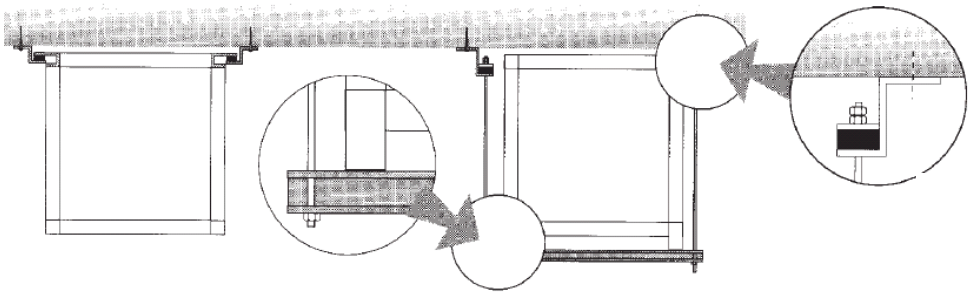


Figure 34: Suspension of ceiling AHUs

AHU which are not designed to stack, may not be stacked (one on top of the other). Spray humidifier will need either one-both sides higher foundations or on one-both sides feet, which are supplied if ordered, refer to **Figure 35**.

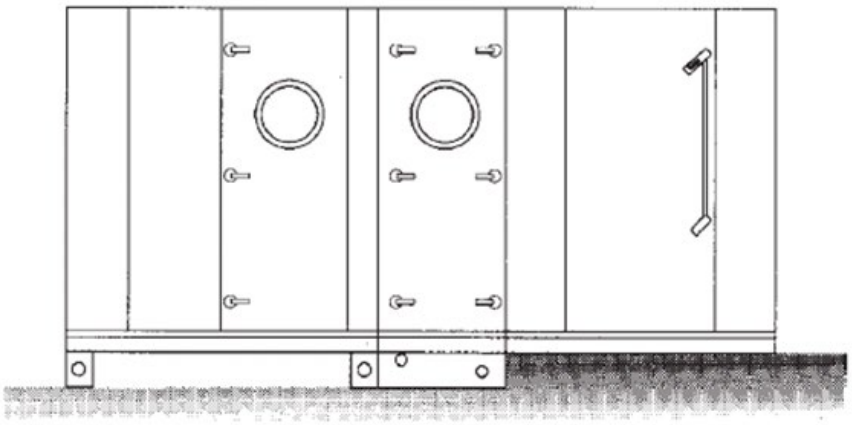


Figure 35: Spray humidifier with both sides feet

Treatment of GfK air washer and plastic parts
Thermoplastics are compared with steel impact and shock sensitive. At low temperatures an additional brittleness exists. Please treat the pieces of fiberglass or plastic such as piping, nozzles and droplet eliminators with caution and care.

4.2.4 Special guidelines for flat AHUs – ceiling AHUs

Usage
- For the suspension under a ceiling.

Assembly of the individual components of the flat AHUs
- The individual components are screwed together by use of easy connection – see **Figure 52** (**chapter 5.1.2**).
- The assembly should still be done on the ground, since the Easy Connection on the top side of the flat AHU may no longer be accessible after positioning on the ceiling.

Suspension
- The dimensioning of the suspension and fixture must be carried out on site and has to be adapted to the size and weight of the flat AHU.
- All necessary material for suspending and fixing the flat AHU on the ceiling, like longitudinal and transverse profiles for bottom side, threaded rods, dowels, etc. must be provided by the customer.

- The suspension can consist only of transverse profiles (transversely to the air flow), as shown in **Figure 36**, or of transverse profiles with additional longitudinal profiles (longitudinal to the air flow), see **Figure 37**.
- In order to prevent deflection of the bottom panel, the maximum distance of the supporting profiles should not exceed 1 m to each other.
- Profiles must be positioned so that downward-opening doors, processes of wells, etc. are not blocked by them, see **Figure 36**.
- Longitudinal profiles are intended to support the aluminum profiles on the bottom edges of the flat AHU.
- Furthermore, it is recommended that the supporting profiles should be screwed together with the aluminum profiles of the bottom edge for secure positioning e.g. by means of threaded rivets.
- To avoid transmission of structure-borne noise is recommended to use sound-absorbing material between suspension and AHU. A possible solution is shown in **Figure 34**.

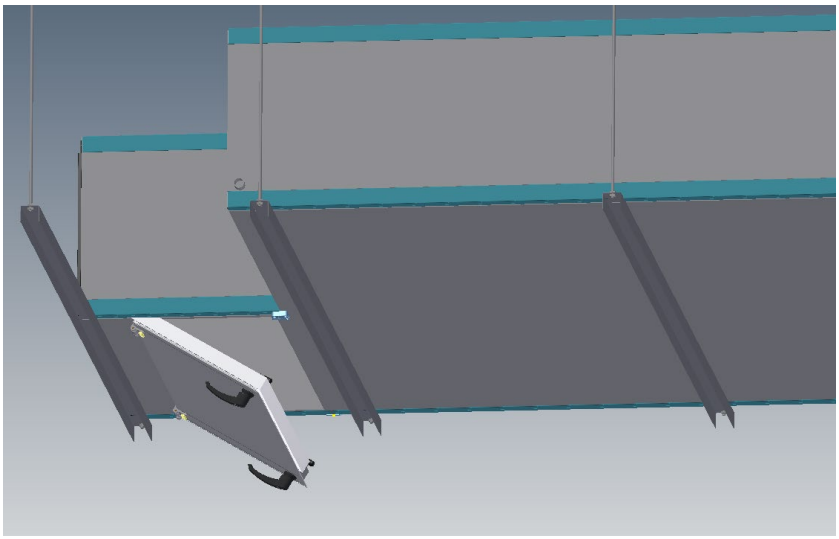


Figure 36: Suspension with transverse profiles

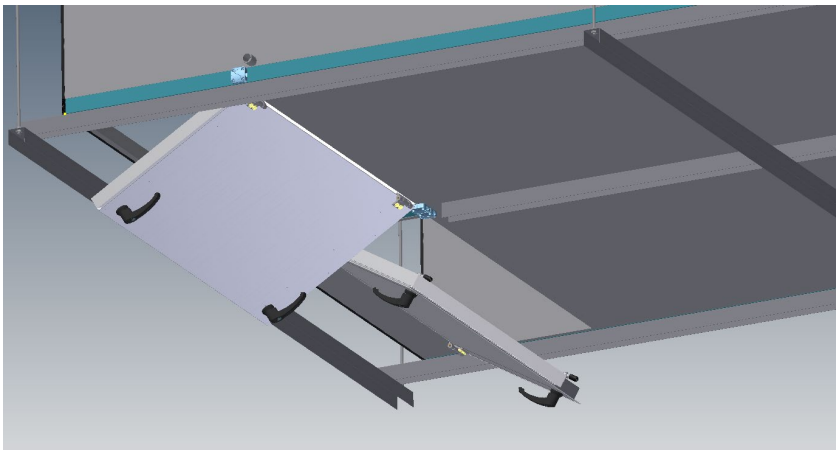


Figure 37: Suspension with longitudinal and transverse profiles

5 Assembly

If climbing on the AHU is unavoidable during assembly, for example, for connecting the roof plates, it must be ensured by appropriate measures. For example, using boards, that the weight is distributed evenly, in order to avoid bending of the roof panels.

Figure 38: 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 39**) must be applied at all section connections before assembling, see **Figure 40.**

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 hood …

Figure 39: Sealing strip

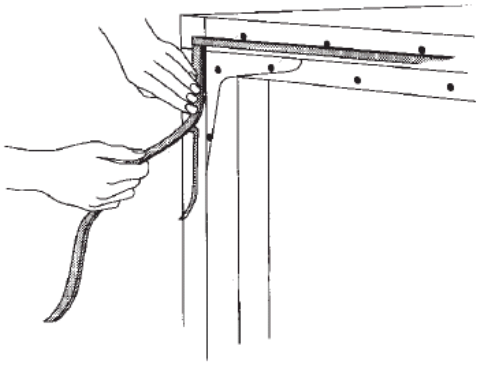


Figure 40: Applying the sealing strip

Section connection points, screw connections between inside and outside, connection openings and bushings, and all other openings which penetrate the casing must additionally be sealed with SIKAFLEX (e.g: heat exchanger connections, mounting screws, duct connections, measuring openings, etc.), as shown on **Figure 41** and **Figure 42.**

For roof AHUs as well as at device separations directly before or after a wet area (e.g. cooler, humidifier, spray humidifier), special actions must be done for sealing. For that purpose, the supplied sealing agent Sikaflex (**Figure 41**) must be used. Further information will follow in **chapter 5.1.5 (Special features for roof AHUs and device separations at wet areas)**.

Figure 41: Sealing agent (Sikaflex)

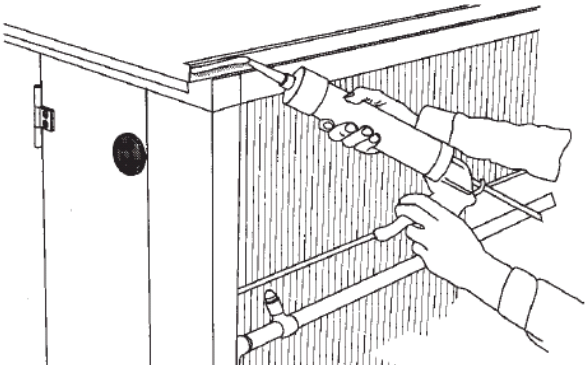


Figure 42: Applying the sealing agent

Pulling together AHU sections

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

The AHU sections can be pulled together with belts which attach on the base frame, as shown on **Figure 43** and **Figure 44**.

Figure 43: Pulling AHU sections together

Figure 44: Pulling AHU sections together (detail)

Remove external panels at butt joints

For aligning and connecting the delivery sections, the external panels shall be removed, unless heat exchanger fittings or similar components prevent this.

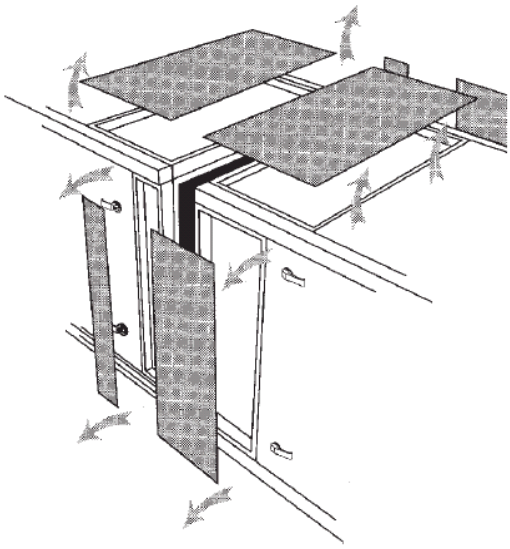


Figure 45: Removable external panels

Procedure:

- **CCE B – Housing type: Snap in construction –** To remove the external panel - start at the corners - use a screwdriver – refer to **Figure 46**. After removing the external panel, remove the insulation.

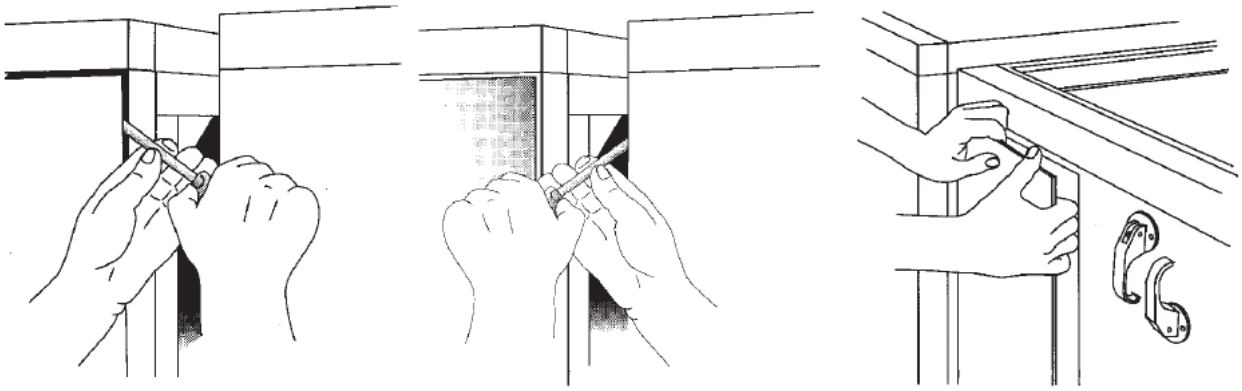


Figure 46: Removal of the external panel

- **CCE C – Housing type: screwing construction –** The external panel is located on the inner panel and is screwed to it using TORX screws (see **Figure 47**). After removing all screws, the outer panel can be removed and the insulation can then be removed.

Figure 47: Fitting the external panels

Figure 48: External panel with unscrewed screws

Figure 49: Removal of the external panels

5.1.2 Standard connections and connection components

The connection via base frame must be always made at all AHUs, see **Figure 50** and **Figure 51**.

Figure 50: Hexagon bolt with locknut M8x20 / M10x30 / M12x40

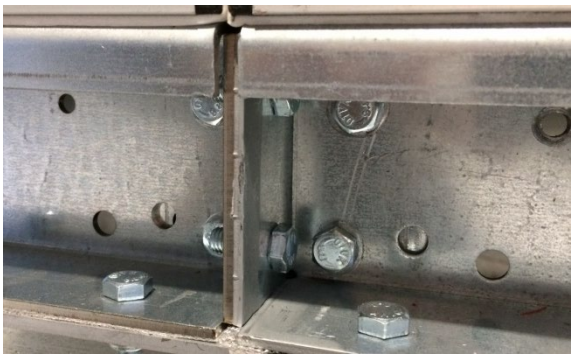


Figure 51: Bolt connection of base frames

Additionally, to the base frame, there are other possibilities for connecting AHU parts. These are dependent on the AHU series and are listed below, ranked by the execution priority.

CCE C:
1. Easy Connection, see **Figure 52** up to **Figure 55**
2. Connection angle, connection frame, see **Figure 56** up to **Figure 60**
3. Connection via panels, see **Figure 61** and **Figure 62**

CCE B:
1. Connection angle, connection frame, see **Figure 56** up to **Figure 60**
2. Connection via panels, see **Figure 61** and **Figure 62**

Figure 52: Easy Connection

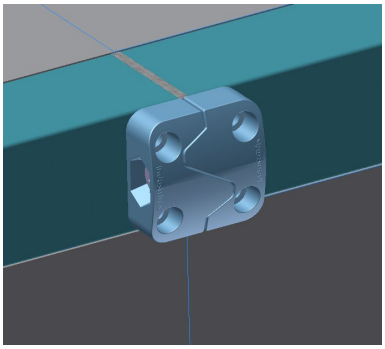


Figure 53: Connection via Easy Connection

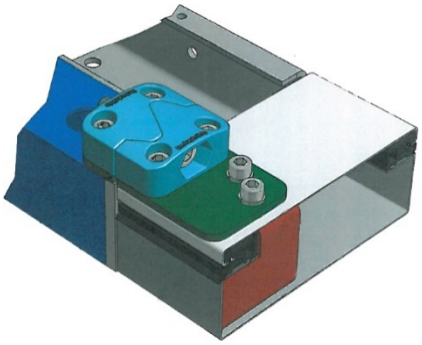


Figure 54: Easy Connection at two-storey AHUs

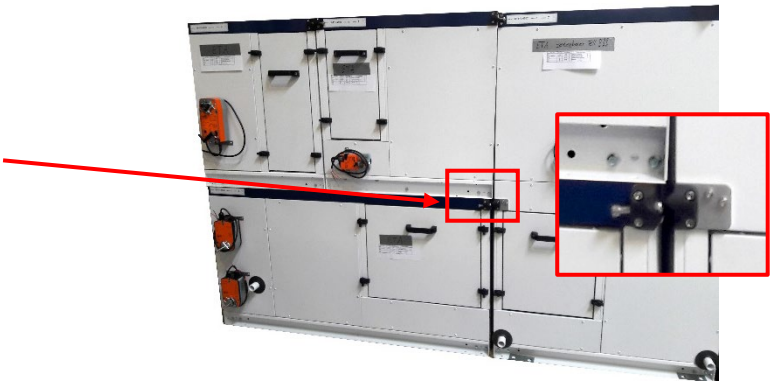


Figure 55: mounted Easy Connection at two-storey AHUs

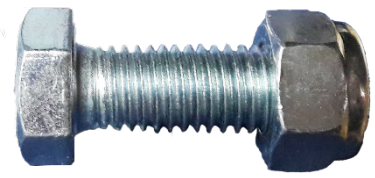


Figure 56: Hexagon bolt with locknut M8x20

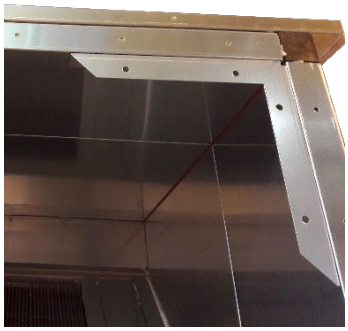


Figure 57: Connection angle

Figure 58: Connection via connection angle

Figure 59: Hexagon bolt with nut M6x6

Figure 60: Connection frame

Figure 61: Hexagon bolt with nut M6x16

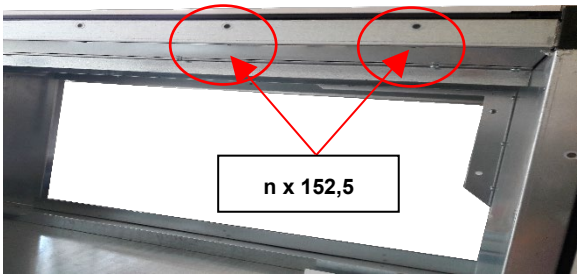


Figure 62: Hole spacing of the internal panel

5.1.3 Detailed solutions and connection components

- **Connection between door frame / door frame and door frame / internal panel**
  Screw spacing: 152 mm

Figure 63: Tapping screw ø8 x 11

Figure 64: Tapping screw Ejot ø8 x 16

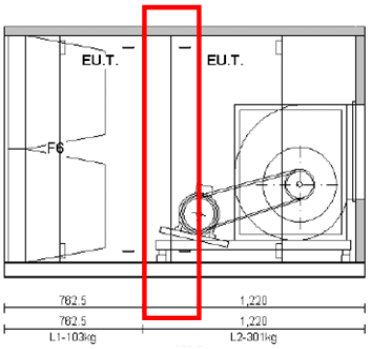


Figure 65: Joint on the AHU drawing

Figure 66: Connection between door frame / internal panel

- **Connection of 3 mm thick casing components without holes**

Figure 67: Self-tapping screw ø6,3 x 22

Figure 68: Application of self-tapping screws

- **Connection of internal panels with the front side of the casing**

Figure 69: Self-tapping screw TORX 25 ø4,8 x 16

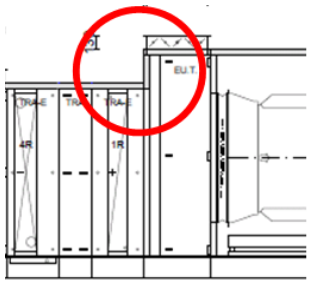


Figure 70: Joint on the AHU drawing

Figure 71: Joint at the AHU

- **Connection of internal and external panel (CCE C)**

Figure 72: Self-tapping pan head screw TORX 25 ø4 x 25

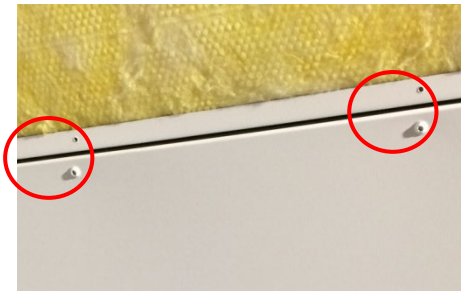


Figure 73: Screw connection of internal and external panel

- **Connection of roof plates**
  Screw spacing: minimum 305 mm

Figure 74: Hexagon bolt with nut (stainless steel) M6x16

Figure 75: Connection of roof plates

- **Connection of connection frame and partition walls**
  Screw spacing: according holes in the connection frame

Figure 76: Self-tapping screw ø6,3 x 22

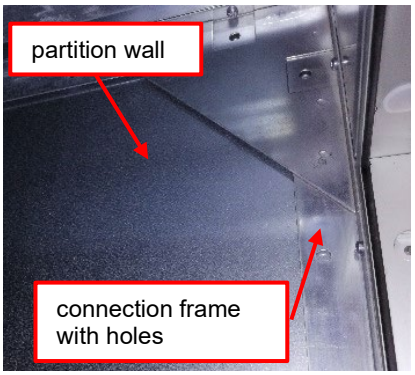


Figure 77: Connection frame and partition wall (not screwed yet)

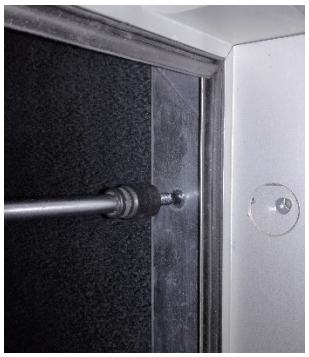


Figure 78: Screwing of the parts

5.1.4 Establishing the screw connection of AHU parts

The exact alignment of the AHU parts and pulling together of the AHU parts as close as possible, as described in **chapter 5.1.1**(**Actions before the assembly of casing**), are requirements for establishing screw connection.

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 79** left).
- If accessible, in the connection angles located in the upper corners of the AHU (**Figure 79** bottom center).

- If accessible, in the circumferential connection frame (**Figure 79** top center).
- In the panels (**Figure 79** right).
- For roof AHUs in the roof flange.

If only one side is accessible (panels and connection frame) the tapping screws ø8 x 11 or Ejot ø8 x 16 shall be used, otherwise bolts and nuts (all supplied separately):
- Bolts M8 x 20 for connection angles and base frame
- Bolts M6 x 16 for connection frame and panels

For the tightness at least every second hole (bolt spacing 305 mm) shall be used.
After placing all the screws loosely, they shall be tightened - starting with the base frame – in two stages.

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

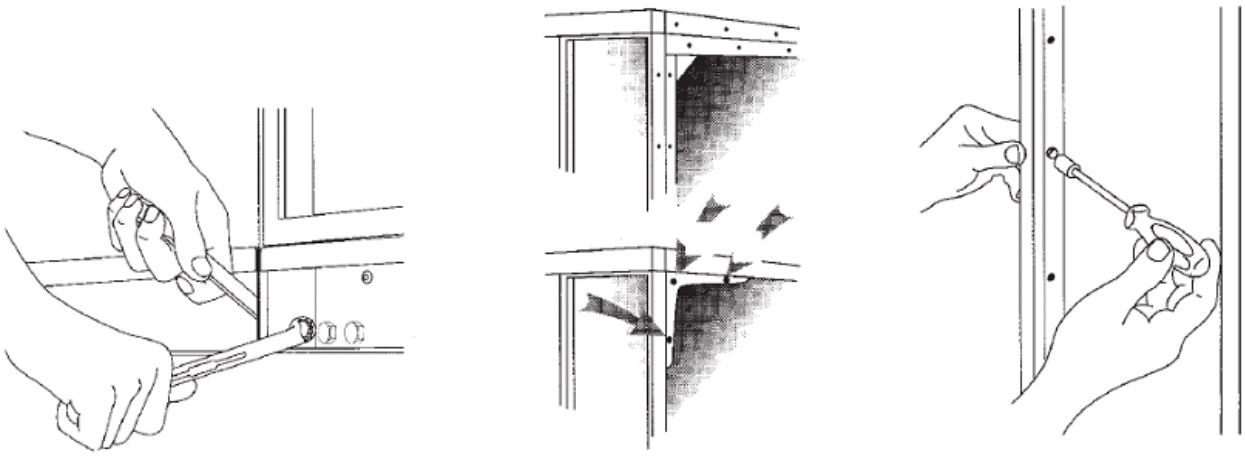


Figure 79: Bolting delivery sections together

Reinsert the insulation and remount the external panel
At AHUs of the series CCE B in outdoor execution or with outer aluminum panels, the white protective film must be removed from the sealing tape before mounting (**Figure 80**).

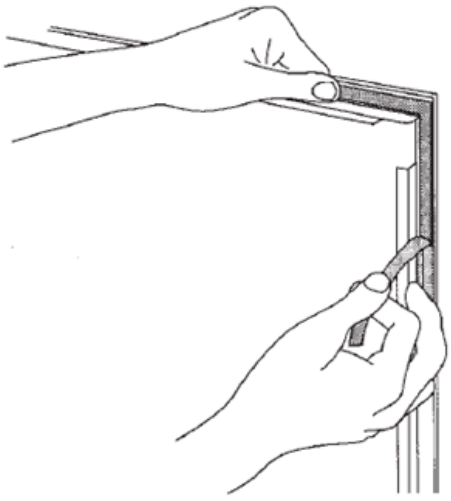


Figure 80: Removing the protective film

- **CCE B – Casing type: Snap-In-Construction**
  Start at the bottom to mount the external panels (**Figure 81**).

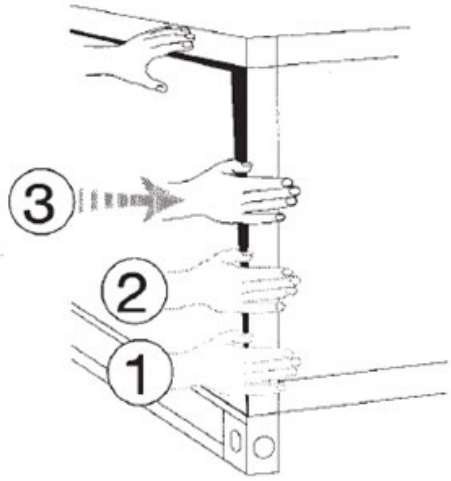


Figure 81: Pushing in the external panel

- **CCE C – Casing type: Screwing-Construction**
  The outer panel lay on the inner panel and fixing with TORX-screws (see **Figure 82**, **Figure 83**, **Figure 84**).

Figure 82: Insertion of the outer panel

Figure 83: Outer panel not screwed

Figure 84: Screwed panel

5.1.5 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, humidifier, air washer), 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 86**). 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 87**), then the joints (**Figure 88**) 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!

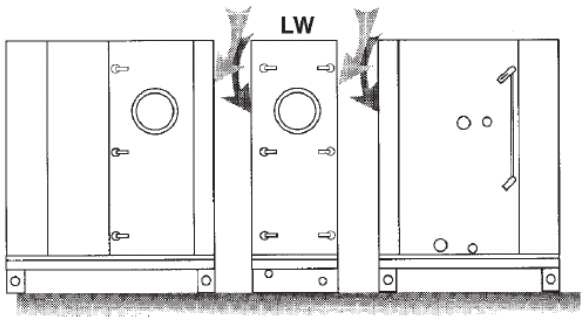


Figure 85: Sealing surfaces at wet areas

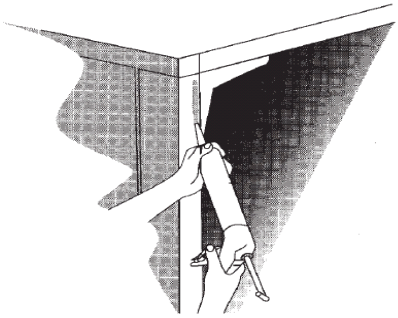


Figure 86: Sealing the frontal joints

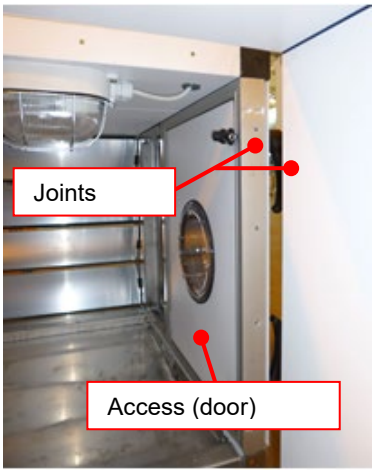


Figure 87: AHU separation accessible via door

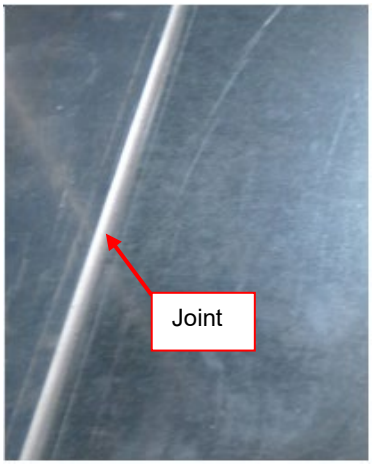


Figure 88: Sealing the section connection (joint) with the sealing agent

For roof AHUs, also the roof flange is to seal, refer to **Figure 89**.

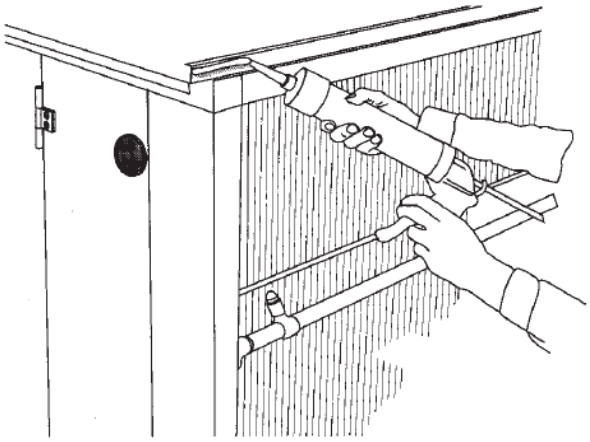


Figure 89: Sealing the roof flange

Sealing of loose delivered base frame cover
Sealings have to be provided at following positions (**Figure 90**):

1. at the base frame cover / base frame valance above
2. at the base frame frontside
3. sealing of the base frame and to the roof profile (at two-storey AHUs)
4. sealing of open base frame holes (if present)
5. at the joints of the base frame covers

After assembling the entire sealing has to be checked.

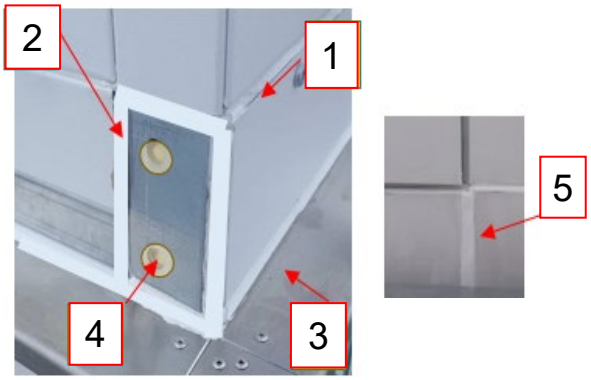


Figure 90: Sealing of the base frame cover

At AHUs in outdoor execution, an additional separation bar (included in the scope of delivery) must be mounted at the separation positions at the roof flange, see **Figure 91**.

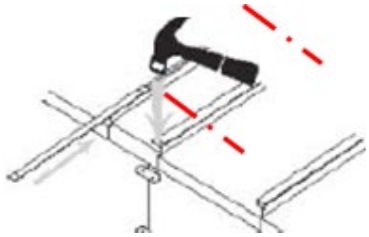


Figure 91: Mounting of the sliding bar

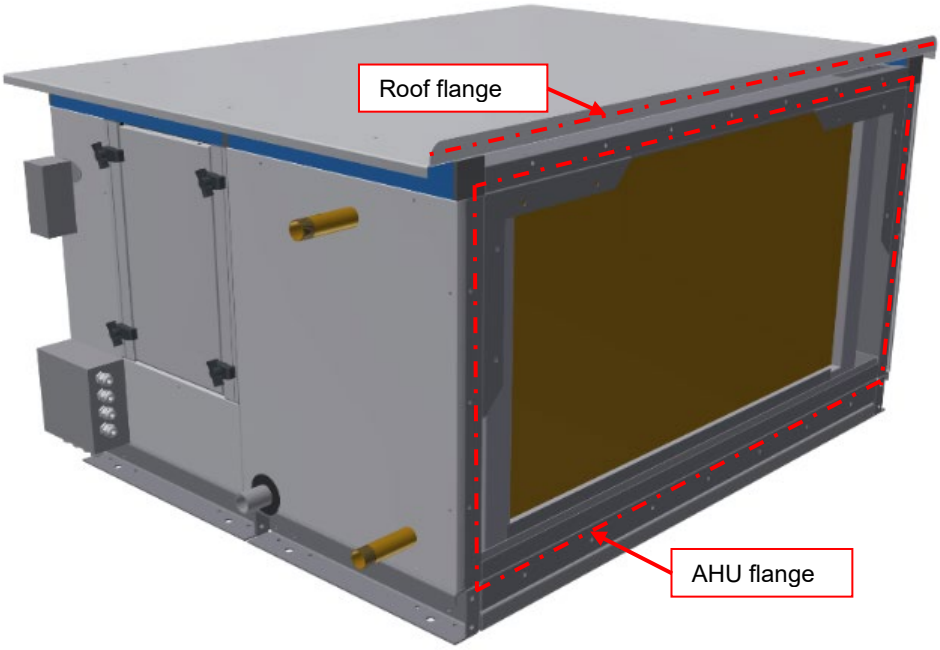


Figure 92: Applying the sealing agent on the frontal joints

Combination AHU in weather-resistant execution side by side

If parts of outdoor AHUs are set up side by side, then the metal sheet roof, which overlaps both parts of the AHU, has to be mounted on site. The scope of supply includes as follows:

- All parts of the AHU with roof inside panel inclusive insulation. The height difference of the roof inside panels on the edges, which cross to the corner profiles, and the top edge of the corner profiles is compensated by a sealing strip and / or a double-sided tape (see **Figure 93**).

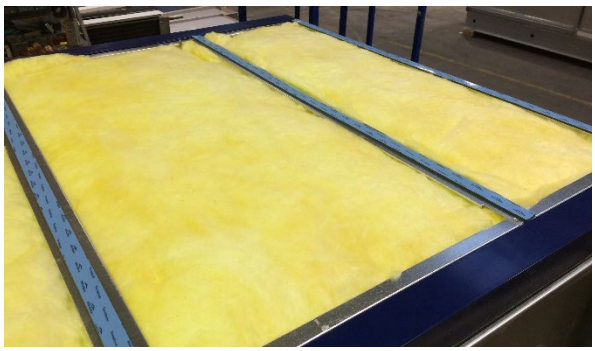


Figure 93: Part of the AHU prepared for assembly of metal sheet roof

- A metal sheet roof, which overlaps the entire width with pre-punched holes. Those are for screwing the metal sheet roof and the casing.
- Sealant (Sikaflex) (see **Figure 95**)
- Drilling screws with sealing ring. (see **Figure 94**)

Figure 94: Drilling screw countersunk head TORX 25 with sealing ring ø 4,8 x 30

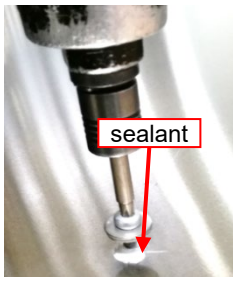


Figure 95: applied sealant (Sikaflex)

Figure 96: Metal sheet roof mounted

At the assembly of the metal sheet roof, proceed as follows:
- Put on the roof sheet according the AHU drawing. Leave the dripping edge 50 mm over. Adjust the sheet edge parallel to the AHU edge.
- Transmit the hole pattern of the roof sheet to the corner profiles of the inner panel.
- Remove the roof sheet.
- Remove the protective foil from the double-sided tape. (see **Figure 93**)
- Put on the roof sheet carefully.
- Screw the roof sheet to the casing with the drilling screws which are intended for this purpose.
- Close all joints between casing and roof with sealant. (**Figure 97**)

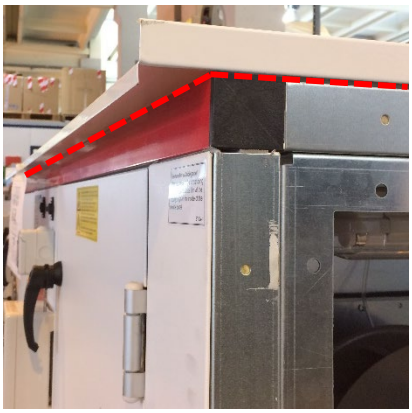


Figure 97: Closing of the joints with sealant

5.1.6 Cable gland

For the connection of engines, pumps, electric heaters, sensors, etc., TRANE loosely supplies material for cable glands (**Figure 101**), which must be installed properly. The following procedure is recommended:
1. Drilling through AHU casing (at right angles to the surface).
2. Enlarge drillings on external panel and internal panel according to **Table 4** (by using a step drill – see **Figure 98**).

Size (of the cable gland)	External drilling diameter (for screwing)	Internal drilling diameter (for sleeve)
M 16	17	19
M 20	21	23
M 25	26	28
M 32	33	35
M 40	41	43
M 50	51	55

M 63	64	71

Table 4: Drilling diameters for cable glands

Figure 98: Step drill

3. Insert sleeve (inside – see **Figure 99**) and screwing (outside – see **Figure 100**) into the drillings and screw them together (see **Figure 101**).

Figure 99: Sleeve

Figure 100: Screwing

Figure 101: Cable gland

A drill with the diameter for the corresponding gland diameter (see **Table 4**, column 2) is sufficient for the insertion of cables into a cabinet or a single walled housing. In this case the screw is locked with the supplied locknut from the inside.

5.1.7 Transport lock

Remove the on fan-motor base frame of spring isolators mounted transport lock (signed with red point) according to **Figure 102** below.

1. Remove nuts and bolts of position 1, 2 and 3
2. Remove z-shaped metal sheet (position 4)
3. Again fasten the nut of position 1, including the potential compensation wire

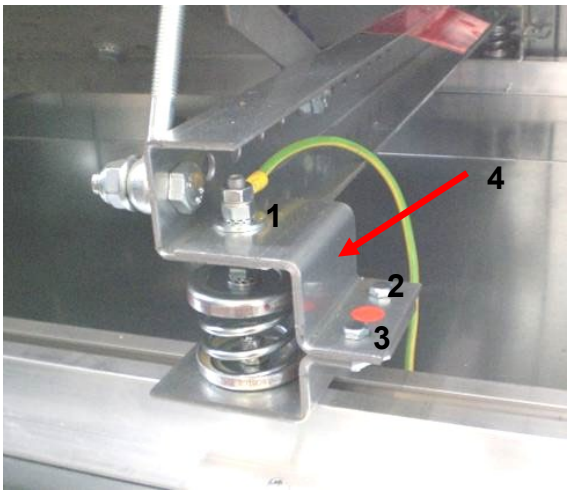


Figure 102: Transport lock

5.1.8 Securing the position of AHUs

Floor AHUs must be fixed on the foundation to secure the position. A direct coupling, see **Figure 103** 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 103** right).

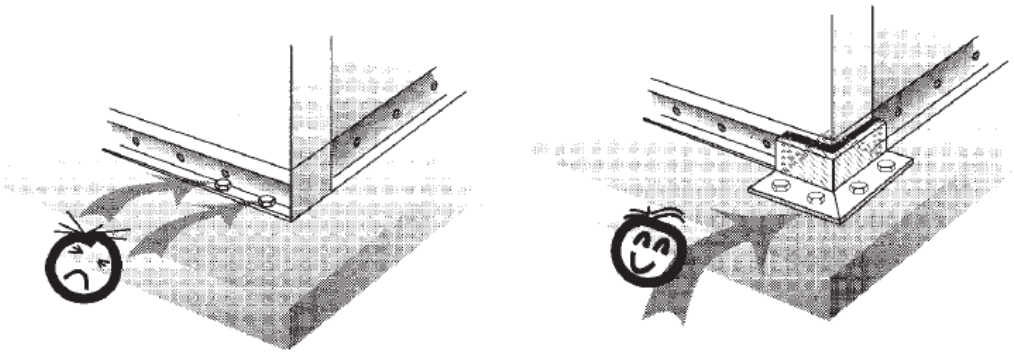


Figure 103: Securing the position on the foundation

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

Hinged doors EU.T (CCE B) and ZIS (CCE C)
The EU-hinged doors in CCE execution have the following design features:
- Space-saving design
- Operated by a handle lever.

For an open door, the handle is in horizontal position; refer to **Figure 104**.
For a closed door, the door is closed, but not locked, the handle is in vertical position, the locking slit in horizontal position; see **Figure 105.**

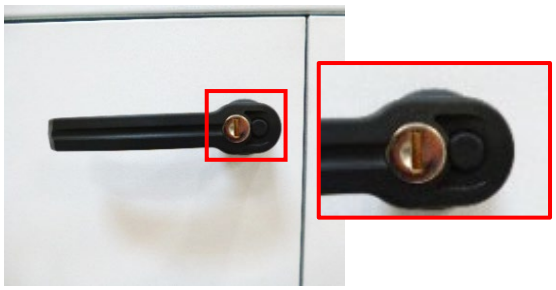


Figure 104: Door ‚open'

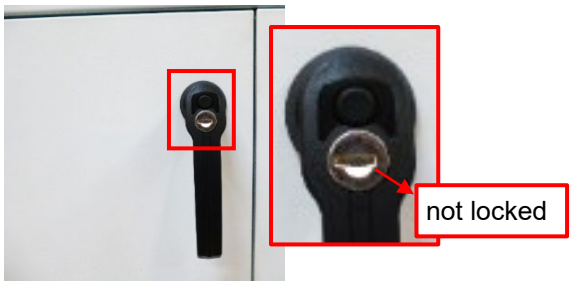


Figure 105: Door ‚closed', not ‚locked'

Doors which allow access to the fan section
- are equipped with a door lock. **Figure 106** shows the lock in the position 'locked', locking slit is in vertical position.
- offer a physical barrier as a protection against the danger zone
- stay securely in position and can be opened only by using a key
- during the operation do not permit access to the fan section

The keys are provided attached to the handle, refer to **Figure 107**.

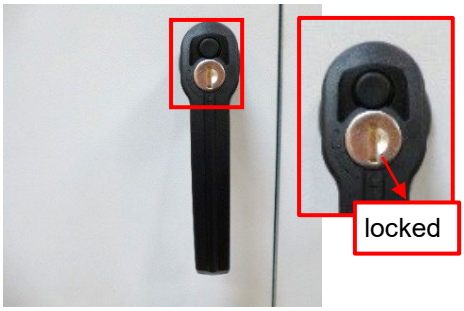


Figure 106: Door ‚closed' and ‚locked'

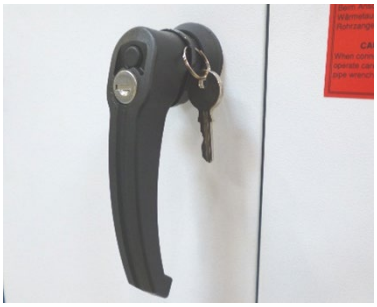


Figure 107: Delivery of the keys

Abovementioned doors with locks are an effective safety device according to EN ISO 12499: there is no situation where entering during fan operation is required, refer also to **chapter 2.1 (Indications for minimizing specific hazards).**

The locking mechanism of the hinged door is on the inside of the door panel and is shown in **Figure 108** (closed position) and **Figure 109** (open position). The rolling piston can be pressed from above (if you are in the AHU) with your thumb in the position 'open'. Thereby, for example, an accidentally trapped person is able to open the locked door from the inside of the AHU.

Figure 108: ‚Closed'

Figure 109: ‚Open'

Hinged doors in C-execution differ just in the casing and hinge execution from the B-execution (see **figure beneath**).

Figure 110: Hinged door (ZIS)

Figure 111: Hinge for C-execution

Figure 112: opened hinged door (ZIS)

Readjustment of the door panel position

Because of the handling of AHU sections, the position of the door panel can move (see **Figure 113** or **Figure 116**). Due to the inclination of the door panel of the EU hinged doors, problems can arise when closing and sealing of the door panel. The door panel can be readjusted through the screws on the hinges. For this purpose, first the screws on the hinge (**Figure 114** or **Figure 117**) must be loosened. Then, the door panel can be brought in the correct position (**Figure 115** or **Figure 118**) and the screws can be tightened again.

Figure 113: Inclined door panel – varying slit width

Figure 114: Adjustment of the door panel (EU.T)

Figure 115: Adjusted – constant slit width (EU.T)

Figure 116: Inclined door panel - varying slit width

Figure 117: Adjustment of the door panel (ZIS)

Figure 118: Adjusted - constant slit width (ZIS)

If the above described readjustment of the door panel is not sufficient, then misalignment in the erection is the cause and must be appropriately corrected.

Removable door panel with locking mechanism TRA (CCE B)
Beside the hinged doors, it is also possible to execute doors as a removable door panel. Clamping means, which are on four, six or more places on the door panel, enable the fixation of the panel in order to provide a closed air duct in the inside of the AHU. On the other side they enable a complete removal of the door panel from the AHU in order to get access to the components inside.

The removal of the door panel from the casing can proceed as follows:

1. Pull forward the black plastic handles.
2. Rotate black plastic handles by 90 degrees.
3. Take door panel with both hands and remove it.

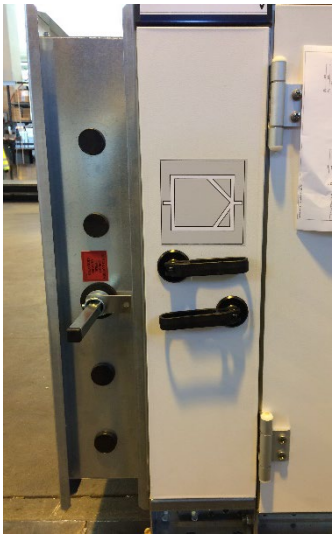


Figure 119: fixed door panel (TRA)

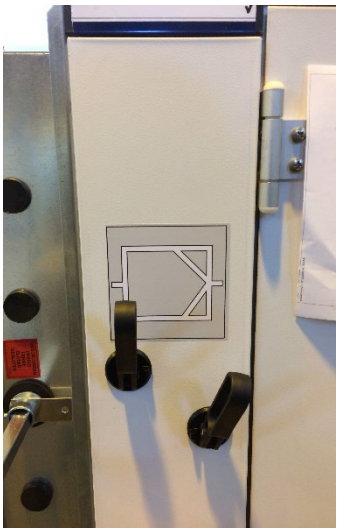


Figure 120: opened door panel (TRA)

Figure 121: removed door panel (TRA)

Removable door panel with screw connection TRA-E (CCE B)
Beside the hinged doors, it is also possible to execute doors as a removable door panel. The fixation of the door panel is made by screws. The screws are put through the prepared holes at the border of the door panel and screwed to the door frame.

Figure 122: fixed door panel (TRA-E)

Figure 123: Undoing the door panel (TRA-E) from the door frame

Figure 124: door frame without door panel (TRA-E)

Removable door panel ZIB (CCE)

Beside the hinged doors, the access to the inside of AHUs with C-casing is also possible by removable panels. At this casing execution, the door panels will be fixed at the door frame by screw connections (see **figure below**).

Figure 125: fixing screw with clamping piece (ZIB)

Figure 126: fixing mechanism at door frame (ZIB)

Figure 127: fixed door panel (ZIB)

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

Attention: Pressure-sided doors represent an increased risk of injury. While opening. They can firstly adhere due to the pressure-difference, and then suddenly detach and fall against the user. The user could also be skidded backwards.
Therefore, particularly when opening pressure-sided doors, it must be done very carefully. Open the door panel carefully and detach it slowly from the sealing. At

the sudden detaching of the panel, 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.

Pressure-sided hinged doors (EU.T. and ZIS) are equipped optionally with an additional safety device against unintentional opening according to EN 1886.
On the inside of the door panel a catching lever is mounted (see **Figure 128** and **Figure 129**). The handle will be turned till this lever connects at the profile. Now, the pressure can escape. Then the door panel can be opened completely.

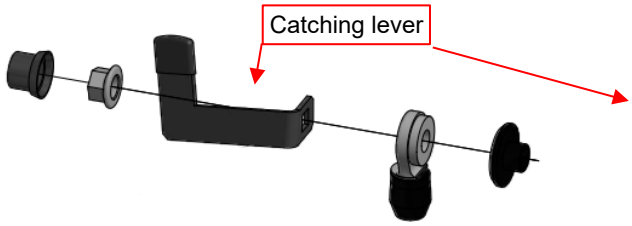


Figure 128: Safety device – catching lever

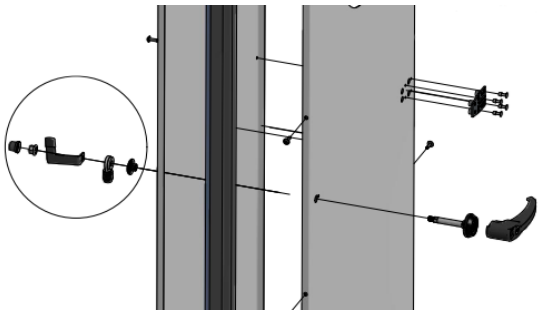


Figure 129: Assembly of safety device on door panel

5.3 Dampers

The closing position of the dampers can be identified in two different ways, see **Figure 130** and **Figure 131**.

Figure 130: Closed position, characterized by a sheet metal position indicator

Figure 131: Closed position, characterized by a marking on the gear wheel

- It is not permitted to drill in the damper, otherwise it may cause damage to the gear wheels and the function of the damper is no longer ensured.
- The dampers must not be strained.

5.4 Airfilters

- Filters, with the exception of laterally removable prefilters, 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 noted, that the filter bags will not be clamped or damaged. Each filter bag must freely adjust itself in the airstream.

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

5.4.1 Panel filter and / or bag filter laterally removable

At laterally removeable filters a pull-out mechanism is included in the scope of supply, see **Figure 133**.

A seal is stuck to the filter. This seal is necessary, to avoid filter-bypass-leakages. If it is not included in the scope of supply of TRANE, it must be provided by the customer.

The seal must be attached on the front side,
- between the filters,
- between filter and door,
- between filter and back side wall.

Figure 132: Pulling out the filters

Figure 133: Pull-out mechanism

5.4.2 Panel filter and / or bag filters in filter frame

Filters are supplied loose and have to be fixed by clips as follows:
1. Take the filter clips, which are included in the supply and are attached to brackets on the filter frame (**Figure 134**).
2. Four filter clips have to be inserted in the respective brackets according to **Figure 135**.
3. Finally, the filter must be fixed by the clips in the filter frame (**Figure 136**).

Figure 134: Delivery of the clips

Figure 135: Insertion of the clips

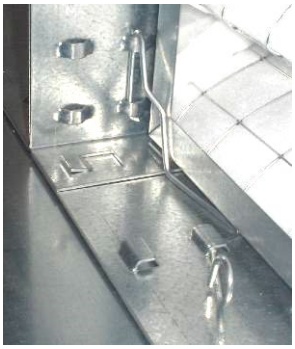


Figure 136: Fixed filter

Bag filters are installed similarly. Bags shells hang vertically.

5.4.3 Laterally removable bag filters with clamping mechanism

When inserting and fixing the laterally 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 137**).
2. Slide one filter after the other in the filter frame (**Figure 138**).
3. Press the last filter of the row against the rear panel. Then press with the lever the filter cells against the sealing (**Figure 139**).

Figure 137: Loosen the clamps

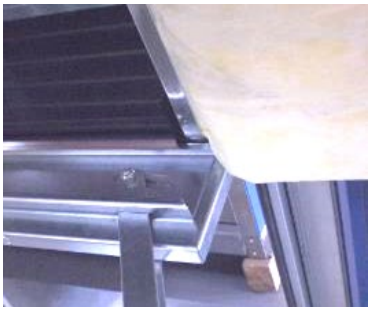


Figure 138: Slide in the filters

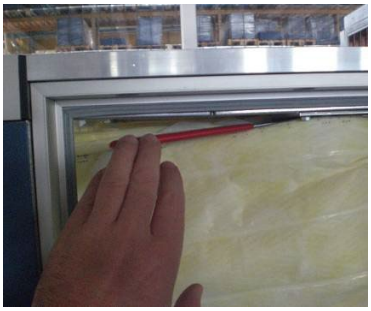


Figure 139: Clamping the filters

Attention: For soft bags the lower bags of the filter cells need to lift up in order to prevent damage with the clamping system (**Figure 140**)!

Figure 140: Lifting the filter bags

Attention: If different widths of filter 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 141: filter frame for different filter sizes

Figure 142: consider the order according the filter frame raster

Figure 143: filter section with inserted filters

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 145**)

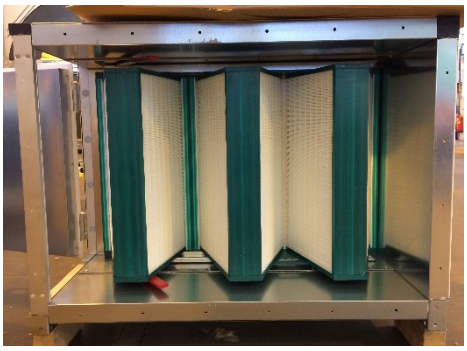


Figure 144: pushing and clamping of the filters to the rear wall

Figure 145: check, if filter lie on the sealing

5.4.4 HEPA filters

If a sealing is not included in the manufacturer delivery, a suitable sealing is delivered (loose) by TRANE. This sealing is then to fix on the filter cell, or alternatively on the filter frame.

The following two installation frames are available for HEPA filters:

Standard HEPA filter frame
The filter mounting frame is mounted in the AHU housing. This fulfils the pre-filter function for terminal HEPA filters.

During installation, the bracket must first be hooked in and then the filter cell inserted, see **Figure 146** and **Figure 147**.

Figure 146: Attaching the brackets

Figure 147: Inserting the filter cell

Depending on the filter type, one of the two systems described below is used for fixing the filter frames:

1. Filter types with frames made of wood-based materials shall be fixed with tensioning corners as shown in **Figure 148** and **Figure 149**.

Figure 148: Inserting the clamps

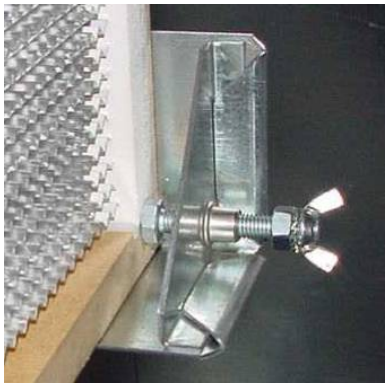


Figure 149: Clamping the filter cell

2. Filter types with metal frames shall be fixed with tensioning corners and additional pressure plates as shown in **Figure 150.**

Figure 150: Filter tensioner with pressure plate

HEPA frame “Filter Safe”:
This is a welded filter frame. It is flanged in between the AHU casing, whereby leakages between frame and casing can be avoided. The filter fulfills the requirements according EN ISO 14644.

5.4.5 Activated carbon filter

Activated carbon filter cartridges (**Figure 151**) are delivered loosely and must be inserted into the dedicated base plate (**Figure 152**) using the integrated bayonet fastenings.

Figure 151: Activated carbon filter cartridge

Figure 152: Base plate for activated carbon filters

5.5 Dampers with external gear wheels

At these dampers, the slats are moved via an external gear wheel connection. The installation of a suitable cover, which protects against injury and prevents the blocking of the gear wheel connection by small parts, has to be done on site and is the full responsibility of the customer (if not chosen as an option and supplied by TRANE).

Figure 153: Damper with external gear wheels

5.6 Hygienic AHUs

- In addition to the actions mentioned here, the instructions according to **chapter 9.12 (Hygienic AHUs)** have to be observed.

- After assembly all grooves and joints at the connection positions must be sealed with the supplied sealing agent.
- In case of replacement of components sealing must be restored.
- Access of components is ensured by door positions upstream and downstream of the component, therefore components are accessible or side removable for cleaning and maintenance.
- Carry out installation of ducts, tubes and electrical installation in order to ensure access and function of doors.

6 Installation

6.1 Heat exchanger connection

6.1.1 General notes

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

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.

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 screwing (**Figure 154**).

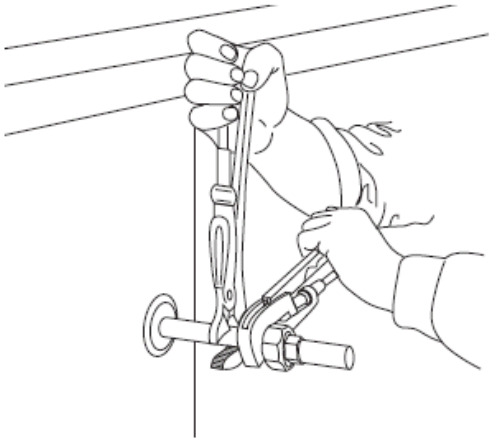


Figure 154: Holding against with a pipe wrench

Recommended sealing material for threaded sleeves:
- Steam heat exchanger, use special sealant
- 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 157**). This coupling could be included optionally in the scope of delivery from TRANE, if not, then it must be provided on site. In order to avoid a damage of the copper pipe of the heat exchanger due to mechanical force, a ring is used to reinforce the copper pipe (**Figure 155** and **Figure 156**).

Figure 155: copper pipe with reinforcing ring

Figure 156: copper pipe with inserted reinforcing ring

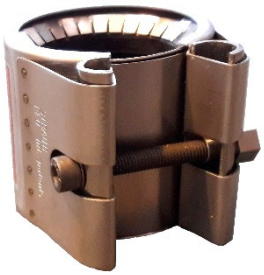


Figure 157: STRAUB coupling

Figure 158: mounted STRAUB coupling

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

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

The connection of the heat exchanger is to execute as indicated on the label on the AHU (connection diagrams in **Figure 159**).

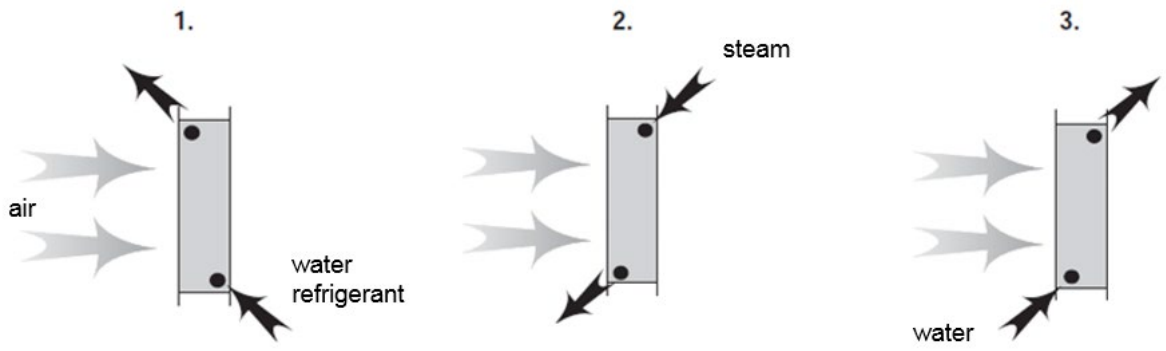


Figure 159: Heat exchanger connection

The heat exchanger operates according to the (cross-)counter-flow principle. Only 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. Steam heat exchangers: steam inlet top, condensate bottom - counter flow
3. Preheat exchanger if there is a freezing risk and can be requested - parallel flow

Hydraulic connection schemes of heating or cooling coil should be carried out as shown in the scheme **Figure 160** with a three way valve as a mixing valve. Compared with a flow control using a straight-through valve this connection avoids unequal temperature profiles, in that way air heating or cooling is quite uniform along the coil surface.

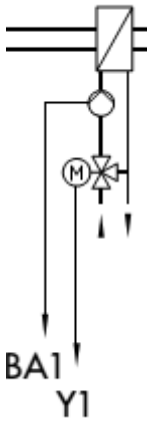


Figure 160: Hydraulic connection scheme

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 161: Drain valve

Figure 162: Vent valve

6.1.2 Steam heat exchanger

The heater is heated to above 70 °C, next to the heater are plastic parts which have been installed. To prevent damage of the plastic parts, it is the responsibility of the client to undertake the following:

- Supply and installation of thermostat
- thermostat trigger temperature: 70 °C

- thermostat probe position: approx. 100 mm downstream of airflow through steam heat exchanger / approx. 100 mm below the top panel
- A thermostat must be integrated into the AHU control system so that the steam supply valve closes in the event of the temperature exceeding the trigger stated above.
- function: interruption of steam supply at over-temperature for example because of missing airflow

6.1.3 Plate heat exchangers for refrigeration circuits

Refrigeration circuits of ETA-POOL-AHUs may contain a condenser for warming the pool water as an option. The connection of the condenser to the pool water or to the water pipes for general use must be done according to the blue arrows shown in **Figure 163:**

- Bottom inlet
- Top outlet

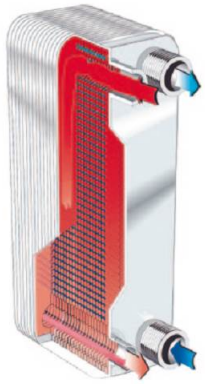


Figure 163: Condenser for warming pool water

Application of plastic water tubes are not allowed because refrigerant - and therefore also plate heat exchanger - may reach temperatures of 110 °C or higher!

- Never add the chlorination in front of the water inlet of the plate heat exchanger. The chlorination should be added as far away from the plate heat exchanger as possible (see **Figure 164**).
- The water inlet should be close to the surface and the outlet near to the bottom. This improves the mixing of the heated water and mainly prevents the entrance of chlorine particles or concentrated solution into the plate heat exchanger (see **Figure 164**).

Warning: Unfortunately, in practice, the chlorination is often located in front of the condenser for warming pool water inlet. This improves the chlorination, but it could potentially damage the plate heat exchanger.

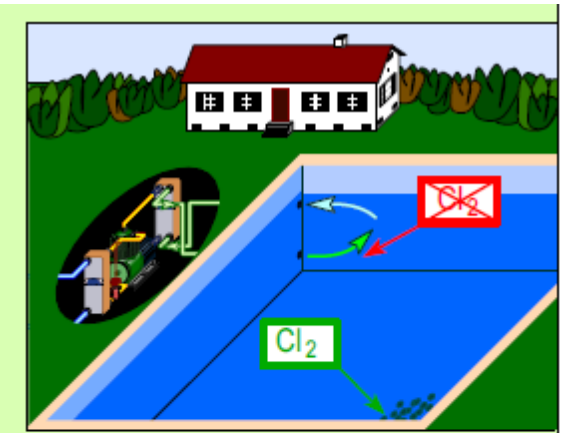


Figure 164: Notes concerning plate heat exchangers

- pH-value: should be kept as high as possible; but at least 7,5
- Cl_2: continuous < 0,5 ppm near the plate heat exchanger inlet
  maximum < 2 ppm
- Cl^- < 150 ppm, if the water is heated to 50 – 60 °C
  < 100 ppm, if the water is heated to 70 – 80 °C

6.2 Humidifier, indirect adiabatic cooling

Humidification systems function in the supply air flow as an air humidifier, as well as in the exhaust air flow as an indirect adiabatic cooling. In the following, reference will always be made to humidifiers in the supply air flow, but the information is valid for both applications, unless explicitly stated otherwise.

6.2.1 Water quality

At the water supply of a humidifier, for instance spray humidifier, pay attention to the water quality. Depending on the water hardness and the operational importance of the device, an appropriate water treatment process must be chosen in order to ensure the desired water quality. Pay particular attention to the carbonate hardness in fresh water. The water treatment system is not supplied by TRANE and must be provided by the customer on site. In order to reach a sufficient operation safety, the circulation water quality should be in following range:

Quality			Air conditioning system for		
			Standard climate requirements	Data-processing areas	Sterile and clean rooms
Appearance			Clear, colorless and without sediment		
pH-value			7 – 8,5		
Total salt content	GSG	g/m³	< 800	< 250	< 100
El. conductivity (at reference temperature 20 °C)		mS/m	< 100	< 30	< 12
		µS/cm	< 1000	< 300	< 120
Calcium	Ca^{++}	mol/m³	> 0,5		-
		g/m³	> 20		-
Carbonate hardness	KH	°dH	< 4		-
Carbonate hardness with hardness stabilization	KH	°dH	< 20		-
Chloride	Cl^-	mol/m³	< 5	-	-
		g/m³	< 180	-	-
Sulphate	SO_4^{--}	mol/m³	< 3	-	-
		g/m³	< 290	-	
$KMnO_4$-consumption		g/m³	< 50	< 20	< 10
Germ count		KBE/ml	< 1000	< 100	< 10
Legionella bacteria		KBE/ml	< 1		

Table 5: water quality of supply of humidifier following VDI 3803

The necessity of a stationary sterilization facility depends mainly on the operation conditions and must be checked for each single case.

6.2.2 Protection of the drinking water against pollution

During installation, it must be ensured by appropriate measures, that the installer complies with EN1717. This European Standard contains general requirements to safety installations, which are purposed to protect the drinking water against pollution. For instance, installation of safety equipment to prevent against drinking water against contamination due to backflow.
Before commissioning, such appropriate measures must be executed by the operator on site to ensure the conformity to EN 1717.

6.2.3 Special indications for different humidification systems

6.2.3.1 Spray humidifier – Installation of the pump circuit

General indications
A spray humidifier could be used for humidification as well for air cleaning, in the function of an air washer. Hereinafter, the term ‘spray humidifier’ is used but the description is also valid if the system is used as an air washer.

Spray humidifier pump circuit is delivered in parts, see **Figure 165**:
1. Pump on anti-vibration socket plate
2. Suction side tube (from water tank nozzle till flexible connector)
3. Pressure side tube (from flexible connector till water tank nozzle)
4. Flexible connecting tubes
5. Threaded strut

The connection between the parts must be made by flexible tubes and clamps which ensure the vibration decoupling of the pump arrangement.

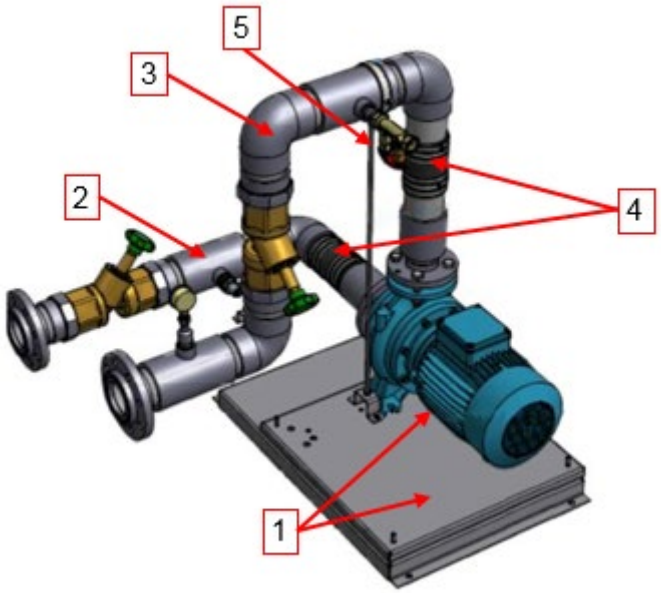


Figure 165: Parts of spray humidifier pump circuit

The assembly of the parts must be completed on site by the customer and has to follow the present description. To avoid the flexible compensator becoming loose due to situations listed below, please follow strictly the described installation process.

The flexible compensator can become loose, if
- delivered number of clamps are not fixed during installation
- installation of different clamps (not the original ones)
- corresponding clamps fixed with too high or too low torque
- flexible tube is not long enough, see **Figure 166**.
- in case that customer applied lubricant at the flexible tube during installation.

In this situation, the relating tube connection may loosen and cause a water leakage and subsequent damages!

To ensure a proper operation and to minimize the risk of water leakage, TRANE highly recommends installing and checking the clamp connections according to the instructions below.

Installation instructions
The assessment of the parts for the flexible connecting tubes and clamps follows **Table 6**.
The table shows the size and the number of clamps depending on the tube diameter. For example, 2+2 means two clamps on each end of the flexible connector.

Rigid PVC tubing diameter pressure side / suction side	Flexible (black) rubber tube	Clamp for flexible tube connection
		Type Normaclamp TORRO 12 W1

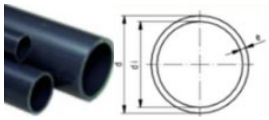
			
outer diameter (mm)	outer diameter (mm)	size	Number for one flexible tube
25	approx. 33	25 – 40	2+2
32	approx. 42	30 – 45	2+2
40	approx. 47	40 – 60	2+2
50	approx. 61	50 – 70	3+3
63	approx. 76	60 – 80	3+3
75	approx. 87	70 – 90	3+3
90	approx. 106	90 – 110	3+3
110	approx. 120	110 – 130	3+3
125	approx. 136	130 – 150	3+3

Table 6: Specifications - size and number of clamps for flexible connecting tubes

The following actions must be carried out separately for the pressure side connection and the suction side connection. Please note, that the tubing on pump suction side and pressure side usually have different diameters.

1. **Flexible tube length:**

- The flexible tube length L is delivered in standard with L = 180 mm. For some installations shorter tubes may be installed. In this case cut the flexible tube to match the drawing in **Figure 166**.
- Ensure, that the free distance between the two ends of the rigid (grey) tubes is not less than 20 mm and not more than 60 mm according the drawing.
- Ensure that the (black) flexible tube covers the (grey) rigid tube ends at each side for a length of 60 mm according to the drawing.
- Mark the correct position of the flexible tube on the rigid tube (60 mm length) before installing the flexible tube.

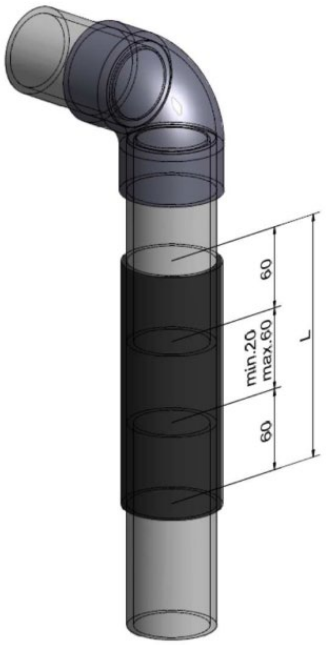


Figure 166: Correct positioning of the flexible connecting tube (black); dimensions in mm

2. Install the flexible tube and clamps

- Clean the plastic tubes and flexible connector tube carefully with a dry and clean cloth
- Check to use the correct clamps: The clamps are imprinted with “NORMA” and the size range must be as indicated in **Table 6**.

Do not apply any lubricant between the black flexible tube and the rigid (grey) tube. This could degrade the flexible rubber tube and reduce the safety of the connection.

Do not use any cleanser of benzene, this could damage the rubber material.

3. Positioning of the flexible tube and clamps

- Check if the flexible tube is positioned correctly overlapping 60 mm on each end the grey rigid tube, according to **Figure 166**.
- Firstly, install loosely the indicated type and number of clamps on each side of the connection.
- Check if the clamps are positioned on each side completely within the 60 mm overlapping length.

4. Fixing of the clamps

- Tighten the clamps using a torque wrench. Fix the screw with a torque of 5 … 6,5 Nm.

Figure 167: Mounted clamps

5. Installation of threaded strut

The threaded strut is mounted on the pressures side and holds the pressure side tube in position, in order to relieve the pressure side flexible tube connection from axial forces. The strut shall be fixed near to the vertical tube coming from the pump pressure side as shown in **Figure 168**.

For installing the threaded strut, the following parts are needed (included in the scope of supply by TRANE), **Figure 168**:

1. Clamp for threaded strut
2. Threaded strut (M10)
3. Base support for strut

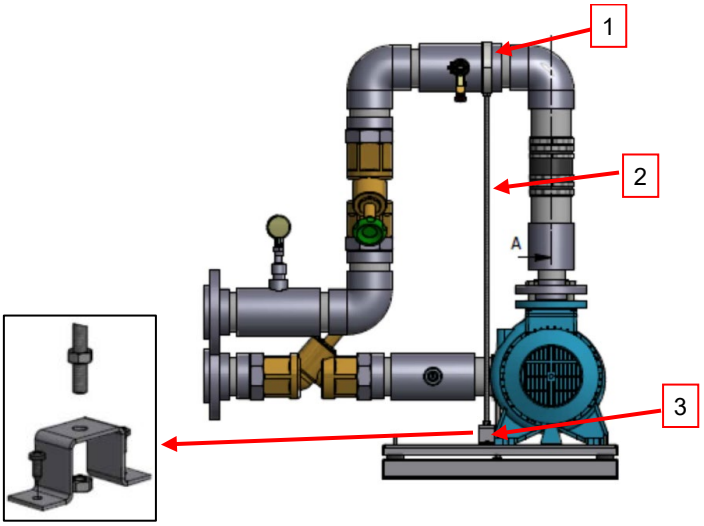


Figure 168: Position and parts for installing the strut

To install the threaded strut, proceed as follows:

- Fix the clamp for the strut at the upper horizontal tube near to the vertical pump coming from the pump.
- The base support shall be installed vertically under the upper clamp. (For spray humidifier equipped with UV water treatment, a small discrepancy may be possible.)
- Cut the threaded rod to the required length and fix the rod accordingly. (For spray humidifier equipped with UV water treatment, the rod may be bent to pass the UV circuit tubes).
- Tighten the lower nut and the counter nut in order to tie down slightly the tube assembly.

In case of problems or needing support with your product, do not hesitate to contact TRANE for any further clarification.

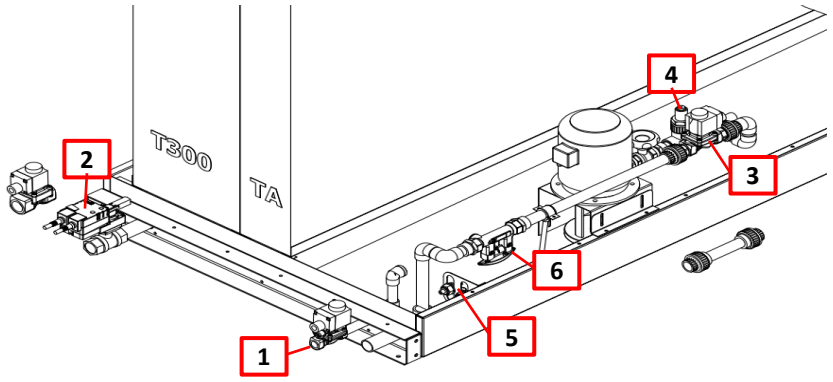
6.2.3.2 Evaporative humidifier

Fresh water operation

A solenoid valve must be provided by the customer on site for the fresh water supply line. If the AHU is equipped with a TRANE control, the necessary power supply is indicated on the wiring diagram.

Circulation water operation

A solenoid valve must be provided by the customer on site for the fresh water supply line and for emptying. If the AHU is equipped with a TRANE control, the necessary power supply for the valves is indicated on the wiring diagram.
The scope of supply includes a drainage solenoid valve, a conductivity sensor, two water level switches (maximum/minimum) and a tacosetter, see **Figure 169**. If no TRANE control is included, the electronic components must be integrated in the customer's control. The water amount of the drainage can be set manually at the tacosetter. At the customer's request simplified systems will be delivered.



1 Fresh water solenoid valve
2 Drainage solenoid valve
3 Blowdown solenoid valve
4 Conductivity sensor
5 Level switch (max/min)
6 Blowdown by tacosetter

Figure 169: Components of an evaporative humidifier system with circulation water operation

6.2.3.3 High pressure spray humidifier

The manufacturer of the high pressure spray humidifier must be contacted for the installation.

6.2.3.4 Steam humidifier

The instructions of the manufacturer of the steam humidifier must be observed for the installation. For example, for the correct installation of the steam hose or for the connection of the condensate drainage.

6.2.4 Connection of indirect adiabatic cooling

ETA-PAC AHUs are equipped with an indirect adiabatic cooling device. Carry out connection to piping system as shown in **Figure 170**.

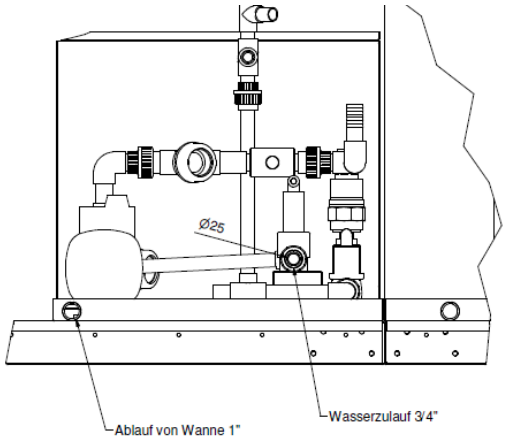


Figure 170: Indirect adiabatic cooling

6.3 Drain for condensate and excess water

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

6.3.1 Standard siphons

A space-saving design of the necessary siphon height can be completed by TRANE on request. Contact your sales representative for detailed information.

The following conditions are essential for correct operation:
- At each drain a siphon must be connected.
- Several drains may 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 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 mmWS = 9,81 Pa

H1 > 1113/9,81 = 114 mm + 15 mm (Safety) = about 130 mm
H2 = 65 mm

Siphon on suction side (in direction of airflow before the fan), see Figure 171.
H1 (mm) > p (mm WS)
H2 (mm) > p/2 (mm WS)

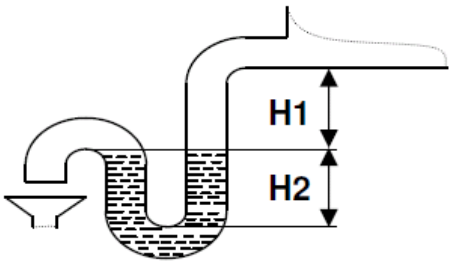


Figure 171: Siphon on suction side

Siphon on pressure side (in direction of airflow after the fan), see Figure 172.
H3 (mm) > p (mm WS)
H4 (mm) ≥ 0

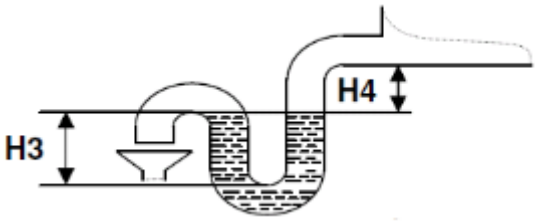


Figure 172: Siphon on pressure side

6.3.2 Ball siphons

If ball siphons with the below shown design are supplied by TRANE, then the following instructions should be observed 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 173**) corresponds to the flow direction.

- Pa = suction side
+ Pa = pressure side

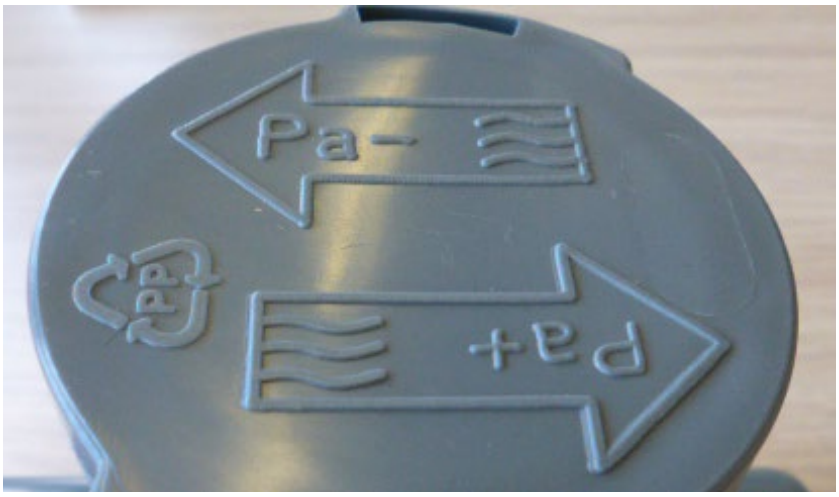


Figure 173: Observe the mounting position - flow direction according to the arrow

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

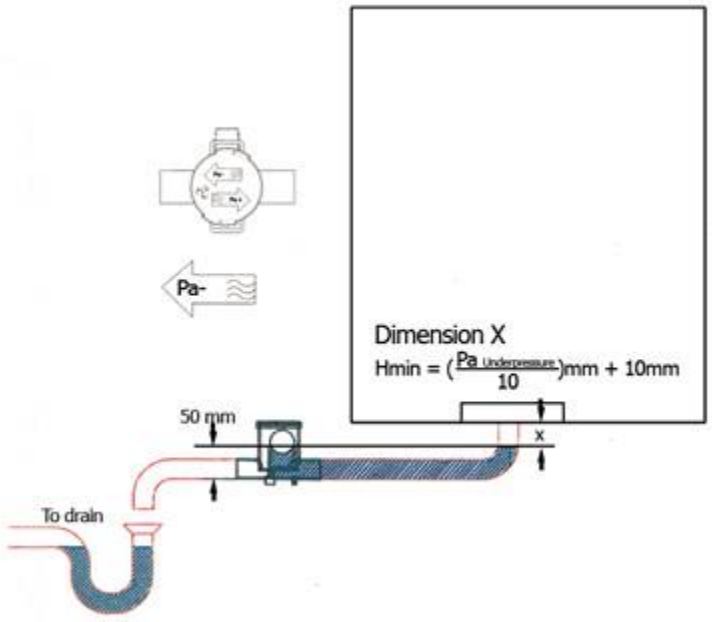


Figure 174: Suction side execution

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

The black plug must be removed for the pressure side installation (see **Figure 176**).

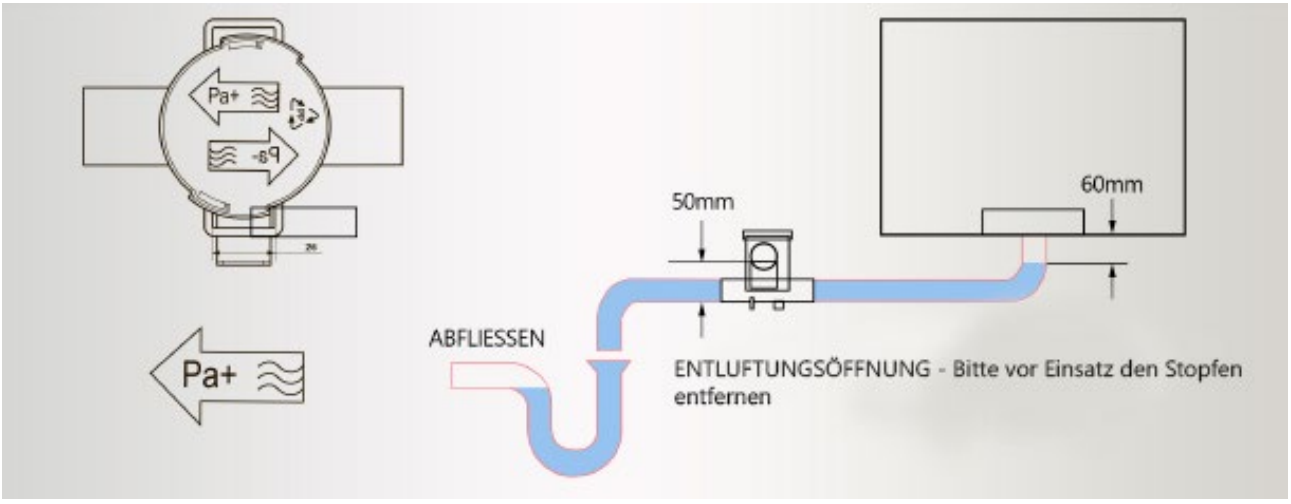


Figure 175: Pressure side execution

Figure 176: Pressure side installation: remove the black closing plug

6.4 Duct connection – airside connection to AHU

Depending on the customer's requirements, TRANE 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:

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 shall be observed.
- 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 tension and torsion free. 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 shall 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 a proper performance of the AHUs, the observance 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.

Mounting components of the duct system directly on the external panel of the AHU

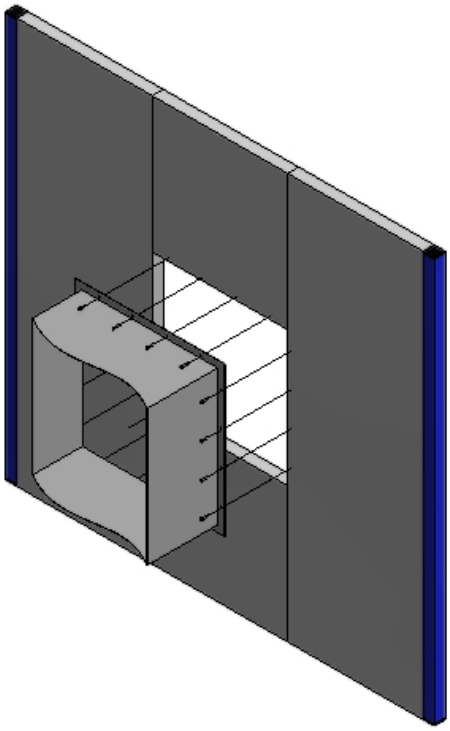


Figure 177: Airside duct connection directly on the external panel of the AHU

The procedure is as follows:

- The dimensions (internal dimensions) of the device opening can be taken from the device drawing or measured directly at the AHU.
- The components of the duct system, which are to be fastened to the respective device opening, must have the same internal dimensions as the device opening!
- A flange contact surface for supporting the components of the duct system is provided around the clear opening - the recommended flange width is 30 mm.
- The components of the duct system can be fastened on this flange surface with self-tapping screws (not supplied).
- Attention: Holes for fastening elements must be installed at a distance of max. 15 mm from the clear device opening. If the distance is greater, then it is not possible to effectively and securely fasten it (see **Figure 178**)!

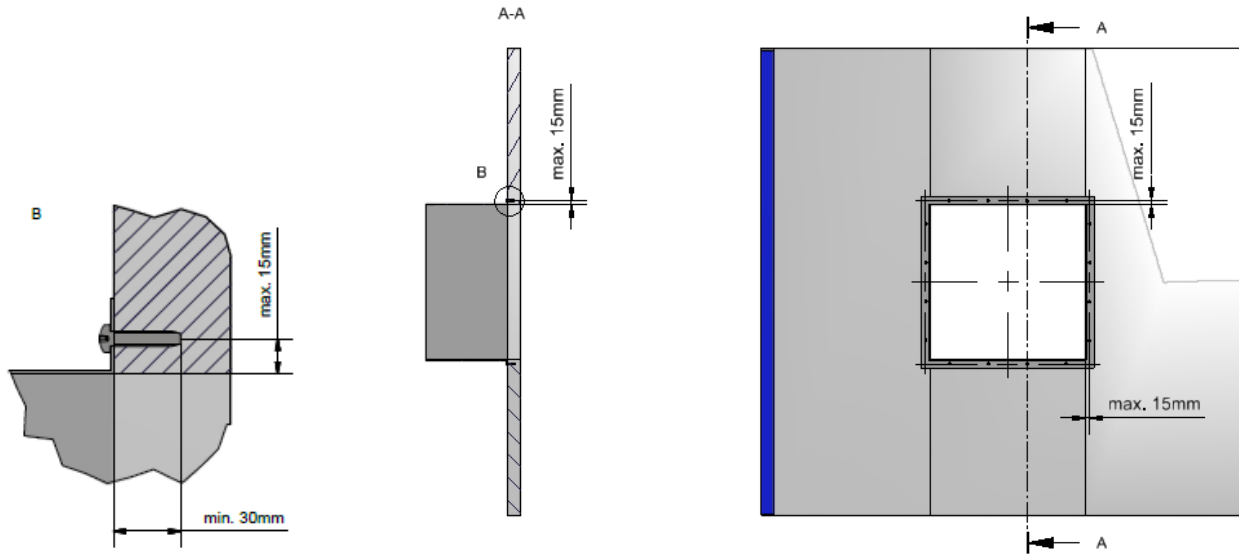


Figure 178: Mounting of duct components on the external panel of the AHU

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 179**.

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

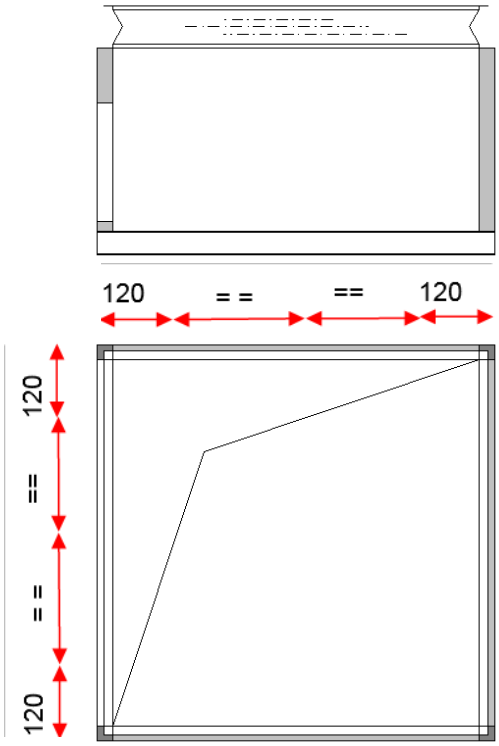


Figure 179: Information on the screw distance

6.4.1 Insulation of fresh air damper

Before connecting the duct section, the flange of the fresh air damper must be insulated in the course of the fresh air duct insulation on site. This action is urgently required to prevent the formation of condensation by heat transfer.
If fresh air dampers are not integrated in the AHU casing, then also the damper frame must be insulated.

6.5 Pumps

- In case of subsequent pump installation, it has to be noted that the intake socket is below the water surface.
- The pump base has to be set so low, that the suction tub declines towards the pump.
- For noise insulation, the foundation shall be executed as the AHU itself (refer to **chapter 4.1 (Foundation)**).
- **Fresh water supply:** The maximum allowable pressure is 300 kPa (3.0 bar).

6.6 Freeze protection measures

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

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 for alarm triggering (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.

At run around systems:
- Usage of water/glycol fluid mixtures with adequate glycol concentration. Performance loss must be considered.

7 Electrical connection

- The electrical connection must be executed in compliance with international regulations such as the Low Voltage Directive and the requirements of electromagnetic compatibility 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 immediately.
- For systems, which operate in hazardous areas, there are special provisions for component / equipment design and used materials. For details refer to **chapter 11 (AHUs in ATEX execution)**.

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 TRANE.

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.

Lightning protection for roof AHUs

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

7.2 AC motors

The three-phase motors fulfill the following criteria:
- Protection class: IP 55
- Thermal class: F
- Type: B3

In thermal class F, the motor can deliver the rated capacity up to
- a coolant temperature (air temperature in the fan section) of 40 °C.
- at an altitude up to 1000 m.

At values that exceed from the above, the load is to reduce.

Single-speed motors
Single-speed motors are suitable for direct and star-delta starting. If the wiring to the AHU outside was done by TRANE, standard wiring is for direct start. Wiring for star-delta start is possible on request.

All single-speed motors are suitable for frequency converters.

Admissible operating range of the motor:
- To ensure an adequate motor cooling the minimum frequency during frequency converter operation must be not less than 15 Hz.
- 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 (Resonance at fans).**

TRANE recommends therefore the continuously monitoring of the operating conditions.

Two or three speed motors
These motors are always designed for direct start in each stage.

These motors are not suitable for frequency converter! A frequency converter destroys the motor winding!

For CCE AHUs the following on site equipment is required:

1) Motor without a frequency converter: motor protection switch
A motor protection switch must always be used when the motor is not running with a frequency converter.
The motor protection switch must be equipped with a thermal switch to protect the motor winding and with an electro-magnetic switch (short-circuit protection). The function of the motor protection switch is to protect the motor against destruction by switching all pools in case of:
- Not start
- Overload
- Decrease of mains voltage
- Failure of a conductor in the three phases power supply

2) Motor with frequency converter: circuit breaker is sufficient
If the motor is operated at the frequency converter, a short circuit protection by a circuit breaker is adequate.

Attention: Danger due to leakage current!
Leakage current exceeds 3.5 mA. It is the task of the operator or the certificated electrician to provide an suitable earth (see **7.1 Connecting to an external protective conductor system)** of the AHU. An incompetently fitted earth of the frequency converter could lead to death or to serious injuries.

In addition to 1) or 2) full motor protection with PTC (thermistor)
As standard a PTC thermistor (specified in the technical data sheet as PTC) is used for:
- Motors for belt-driven fans capacity >= 11 kW

- As an option for smaller capacities available
- For all plug fan motors

To prevent motor damage, the PTC must be connected to a PTC relay. The PTC relay does not replace the motor protection switch or circuit breaker and is needed in addition. The connection to a PTC relay is a prerequisite for the warranty of the product in case of winding damage.

The full motor protection consists of temperature sensors and a PTC relay (on site). On frequency converters this function is integrated.

How it works: For single-speed three-phase AC motors, 3 temperature sensors are installed in series on the exhaust air side of the motor in the winding head. At 135 °C, a sharp increase of resistance occurs, which switches the PTC relay off. For an example of connection diagram refer to **Figure 181**.

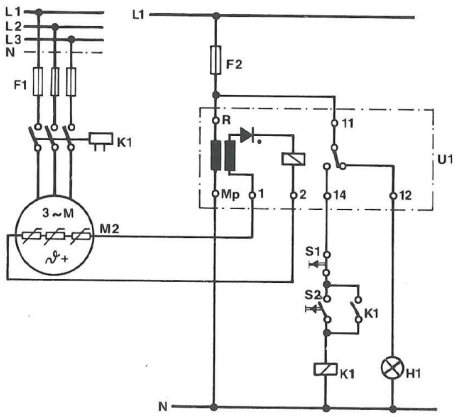


Figure 180: Wiring diagram for thermistors

The full motor protection switches off the motor in case of:
- Overload of the motor
- Poor cooling
- Bearing damage
- Block of the rotor
- Winding problems

Voltages must not exceed 5 V at the temperature sensor. This leads to its destruction!

Alternative to PTC: Motors with integrated bimetal sensor (thermal contact, Clixon) - optional
Bimetal detectors are used for thermal monitoring of motor windings and consist of two successive rolled metals, with unequal thermal expansion coefficients. When they are heated, they expand unevenly and can switch a contact. They have the advantage that they can be placed directly on the switch and so no special relay (as for PTC) is needed.

Block diagram for connection: refer to **Figure 182**.

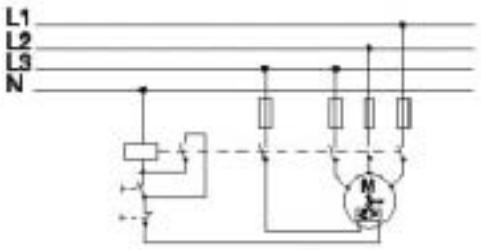


Figure 181: Wiring diagram for thermal contacts

ETA - AHU

These AHUs are as, standard equipped, with a circuit protection switch and frequency converters, if not equipped with EC motors. When the motor is equipped with a PTC, it is connected to frequency converter to monitor the temperature.

Motor connection

The three-phase motor must be connected dependent on the used supply voltage, according to the information on the rating plate (see **Figure 183**) and in the terminal box (see **Figure 184**) of the motor.

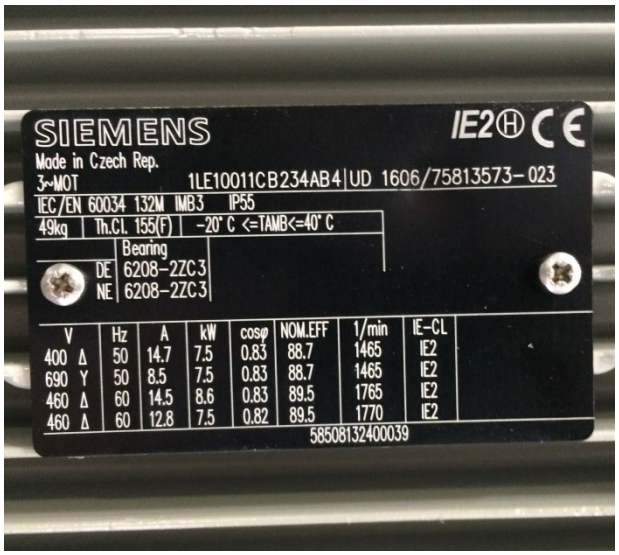


Figure 182: Motor rating plate

Figure 183: Motor terminal box

Cable type for motor connection

The motor can be powered directly or via a frequency converter. A shielded cable must be used for the motor cable and the shield must be grounded on both ends (frequency converter / main switch & motor).

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 187**, for plug fan refer to **Figure 185**, for fan with housing refer to **Figure 186**.
Before connecting the motor check the rotating field of mains connection with a suitable device. Afterwards, connect the phases accordingly to motor terminal or main switch (if supplied and wired by TRANE).

Figure 184: Rotation marking of plug fans

Figure 185: Rotation marking of housing fans

Figure 186: Rotation marking of EC fans

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

	**Thread Ø**		**M4**	**M5**	**M6**
	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 coincides 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.

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

- 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 (Resonance at fans).**

TRANE recommends therefore the continuously monitoring of the operating conditions.

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).

7.4 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. In OFF position 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 7.9 (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 187: Main switch

CCE-AHU with TRANE-control

- 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
  a) items 7 to 9
  b) item 10, implementation of emergency stop function in control system

CCE-AHU without TRANE-control
- The specified main switch must be provided by of the client
- Is to carry out independent from TRANE supply of main switch for fan motor. Fan motor main switch cuts just the motor off.
- Furthermore, on responsibility of the client must be ensured that all items 1 to 10 of the above specified **Requirements according to DIN VDE 0660 and IEC 947-3 on a main switch in RED-YELLOW execution** are fulfilled

7.5 Variable, frequency-controlled drives (VFD, frequency converters)

If the frequency converter is supplied from someone else than TRANE, please note the following points to ensure proper operation:
- Suitability for fans with variable torque.
- The frequency converters supplied by TRANE are usually equipped with interference filters. The interference filter must be compatible with the on-site power supply system.
- The current output of the frequency converter must be compatible with the nominal motor capacity.
- The frequency converter must be adapted for the installation type (IP rating, type of ventilation, temperature, electromagnetic environment ...)
- If the frequency converter will be mounted in the fan section, the frequency converter must be equipped with a separate display unit.

In this case, the display is to be kept on the outside of the AHU - operating in the fan section is not permitted for safety reasons!

When using residual current devices (RCD), the supply cable has to be equipped with a RCD, which is approved for frequency converter (Type B or U, 300 mA).

Plug fans
When using this type of fan (fan with direct-coupled motor-wheel), a frequency converter is necessary to reach the operating point.

7.6 Electric heaters

An electric heater is designed to heat the airflow, which is stated on the technical data sheet, from the specified air inlet temperature to the air outlet temperature. TRANE provides electric heaters with one or more stages according to customer requirements.
The control of the electric heater provided by the customer can be carried out 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)

Fire risk!
With the electric heater in operation, the heating elements may arrive to a temperature of several hundred °C.
In case of malfunction, for example, heater in operation without adequate airflow, inadmissible temperatures may occur. Furthermore, plastic parts for example, filters, gaskets, droplet eliminators etc. close to electric heater may 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 mentioned risks, TRANE provides, as standard, electric heaters with 2 independent safety thermostats.

7.6.1 AHUs equipped from TRANE with control

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

The execution and function, as specified below, is supplied by TRANE.

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 especially observed, when the AHU is only operated with a partial air flow (e.g. in times of reduced use of the building).

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 in the AHU.

Avoid overheating of AHU components by residual heat of electric heater
In order to avoid excessive heating of components by residual heat of electric heater control ensures that fan motor keeps on running for at least 5 min after cutting off of electric heater! By using an enabling contact (see **Figure 192**) the control engineering also ensures that the electric heater can only start its operation when the fan is running.

If in case of main power failure (for example lightning stroke) this automatic run cannot be ensured, AHU may become damaged by the residual heat of the electric heater.

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 2 contactors in serial connection!
The 2 safety thermostats protect the AHU in two independent ways:
Firstly: By hardware via contactors in the power supply.

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

- The 2 safety thermostats are connected in serial connection.
- The 2 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 189 and Figure 190)

- Position of thermostat body: fastened 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 stop in case of over temperature because of low airflow issues

Cover cap on reset button

Reset button

Figure 188: Thermostat with cover cap on the reset button

Figure 189: Thermostat with uncovered reset button

Thermostat 2 (Figure 191)

- Position of the thermostat casing: fastened 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 stop in case of over temperature because of missing airflow

Figure 190: Thermostat 2

Connection box may 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 TRANE:

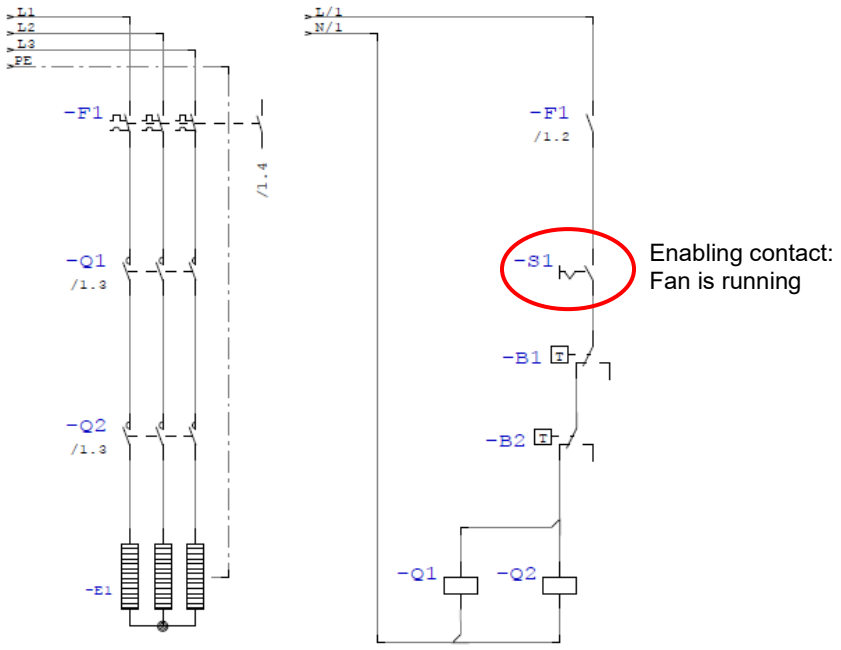


Figure 191: Connection scheme for electric heater

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

7.6.2 AHUs which are not equipped from TRANE with control

Supply of TRANE contains:
- 2 independent safety thermostats
- assembly of the safety thermostats

The **safety related correct implementation of control** has to be carried out **on site and is the full responsibility of the client to do so.**

The minimum safety requirements described in **chapter 7.6.1** (**AHUs equipped from TRANE with control**) have to be ensured and is the full responsibility of the customer to do so.

7.7 Differential pressure restriction for plate heat exchangers

7.7.1 General indications

Plate heat exchangers are only partly pressure resistant.

Through incorrect installation, commissioning or operation by the user of the system, the pressure between supply and exhaust air in the plate heat exchanger may rise inadmissibly and destroy it.

The damages are costly.

The maximum allowed pressure difference of the plate heat exchanger is given in the plate heat exchanger section – supply air in the technical data, see **Figure 193**. In the part of the technical data of the exhaust air this value is not given, see **Figure 194**.

PT	Plate exchanger - diagonal				2.287,5 [mm]	18,74 [m2]	993,00 [kg]	180 [Pa]
Type	FI AL 14 N 1825 U 1 AE SM BHBP155				Max. allowed pressure difference			2.000 [Pa]
With bypass	155,0 [mm]						Density [kg/m³]	1,20
Winter condition					Cooling condition			
Exhaust [m³/h]	11.627	air-side humid p.d. [	174		Exhaust [m³/h]		air-side humid p.d. [P	
Entering [°C]	22,00	Humidity [%]	50,0		Entering [°C]		Humidity [%]	
Leaving [°C]	2,30	Humidity [%]	100,0		Leaving [°C]		Humidity [%]	
Supply [m³/h]	11.627	air-side humid p.d. [	167		Supply [m³/h]		air-side humid p.d. [P	
Entering [°C]	-12,00	Humidity [%]	90,0		Entering [°C]		Humidity [%]	
Leaving [°C]	17,30	Humidity [%]	10,0		Leaving [°C]		Humidity [%]	

Figure 192: Plate exchanger section in technical data – supply air – maximum admissible differential pressure

PT	Plate exchanger - diagonal	2.287,5 [mm]	18,74 [m2]	993,00 [kg]	190 [Pa]

Figure 193: Plate exchanger section in technical data – exhaust air

Possible causes for inadmissible pressure increase:
The following factors can cause pressure increasing and destroy the plate heat exchanger:
- Dampers are closed or will be closed or open in delay.
- Filters were not changed if they reached their final pressure drop.
- The external pressure drop is higher than calculated.
- Dampers in the duct system, unintended barriers, closed outlet grille or unfinished duct systems can lead to additional external pressures.
- Only one fan is working (supply- or exhaust air), which can increase the pressure in some cases.

7.7.2 Prevention measures

General measures:

It must be ensured on site, that all dampers, which have a pressure-increasing effect. For example, outside air dampers, exhaust air dampers, dampers in ducts, are not completely closed during commissioning and operation!

Unless otherwise stated, the assumed pressure situation in the ducts (suction and pressure side) for the technical design is based on the specification of EN13053. The real pressure situation in the ducts must be checked before commissioning. If there are any deviations, TRANE must be contacted.

In principle there are different technical measures, which contribute to the prevention of inadmissible pressure in the plate exchanger. One of these measures is described in **chapter 7.7.3**.

7.7.3 Pressure monitoring with differential pressure switch

Additionally, to the general measures, pressure monitoring may protect the plate exchanger against damage caused by steady pressure increase, **but not if the pressure increases abruptly.**

One possibility for pressure monitoring is a differential pressure switch. The usage is described as follows:

- Depending on the fan arrangement, one or two differential pressure switches must be provided, see **Figure 195** to **Figure 198**.
- The differential pressure switches monitor the differential pressures, which the plate heat exchanger is exposed to.
- If the measured pressure exceeds the admissible, adjusted value, the differential pressure switch shuts off the concerned fan motors. For this purpose, the switches must be installed (airside and electrical) as follows.

Airside connection of the pressure switch depending on the fan arrangement

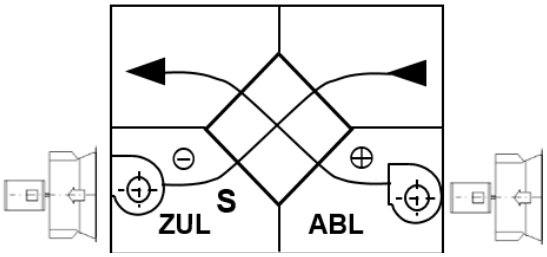


Figure 194: supply air sucking, exhaust air pressing; 1 pressure switch (S), 2 measuring points (+/-)

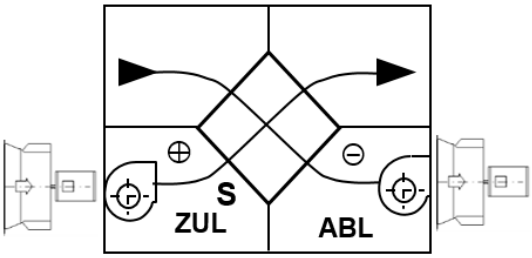


Figure 195: supply air pressing, exhaust air sucking; 1 pressure switch (S), 2 measuring points (+/-)

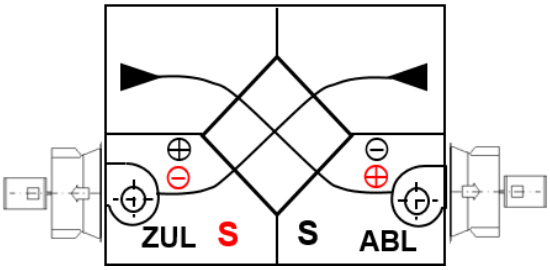


Figure 196: supply air sucking, exhaust air sucking ;2 pressure switch (S), 4 measuring points (+/-)

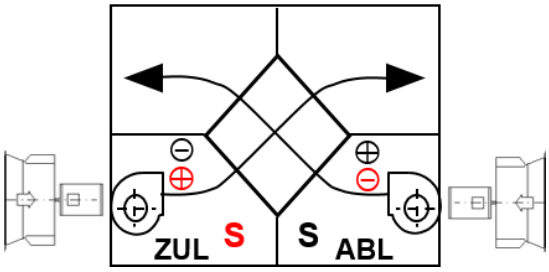


Figure 197: supply air pressing, exhaust air pressing; 2 pressure switch (S), 4 measuring points (+/-)

Electrical connection

The electrical connection of the fans must be done on site, that means it is in the area of responsibility of the customer, that when exceeding the maximum allowable differential pressure, the fan motors will immediately be disconnected from the power supply until the restart by hand. For an example for connection diagram: refer to **Figure 199**.

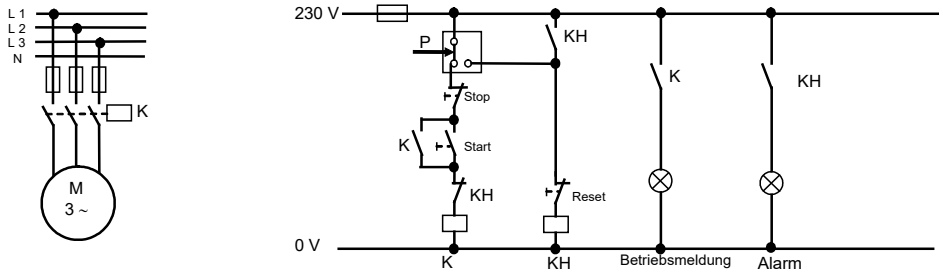


Figure 198: Electrical connection scheme

When the differential pressure switch has been activated, the cause of the excessive pressure must be found and eliminated before restarting.

Value to be set:

The setting of the differential pressure switch must be done on site, based on the actual pressure situation on site. The actual differential pressures must be measured at the commissioning with the target volume flows – measuring points depending on the fan arrangement can be found in **Figure 195** to **Figure 198**. From the beginning until reaching the target volume flow, the maximum admissible differential pressure according to the technical data must not be exceeded. Based on these measured values reserves for, for example, filter pressures losses or other additional pressure losses must be added. This calculated pressure must be adjusted at the differential pressure switch as trigger value.

It must be confirmed, that this calculated value does not exceed the maximum admissible differential pressure according to the technical data, see Figure 193.

If the maximum admissible differential pressure is not given in the technical data, TRANE must be contacted.

If TRANE supplies the differential pressure switch, then they are factory mounted. The setting, as described above, must be executed by the customer on site at commissioning. The correct connection of the measuring hoses, according to **Figure 195** to **Figure 198**, must be ensured before commissioning.

If you have any questions or doubts regarding the correct installation, connection and adjustment of differential pressure switches or other measures to protect against impermissible pressures, please contact TRANE.

7.8 Frost protection for plate heat exchanger

At low temperatures and high air speeds, the condensate in the plate heat exchanger can freeze and cause its icing.
For devices supplied by TRANE with control, this is prevented by pressure monitoring of the plate heat exchanger and the temporary adjustment of the supply air volume flow. For devices supplied by TRANE without control, appropriate measures are required to protect the plate heat exchanger on site. For example, a temporary reduction of the supply air flow.

7.9 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 will have lights fitted on site make sure that sections with condensate (cooling sections), humidifier 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).

7.10 UV section

This section contains UV-C-lamps to destroy germs on surfaces as well as in the air in the direct radiation area. If nothing else is agreed, these lamps should be mounted as evenly as possible and distributed on the ceiling, the rear sidewall and on the bottom. The number of lamps to be installed will be determined in consultation with your TRANE office.

TRANE is not able to determine, the amount of germs killed through the use of UV-C-lamps.

The lamps will be mounted, cabled and led to the junction box (inclusive switch) outside of the AHU by TRANE.

- The safety instructions in **chapter 2.1 (Indications for minimizing specific hazards)** and the user manual of the lamp manufacturer (delivered with the present instruction manual) have to be considered.
- Due to the high voltage of the lamp, maintain it safely and do not work with it whilst it is on. Danger of life due to electrical shock!

- **DANGER:** UV-risk class 3. These lamps emit strong UV radiation, which could lead to serious injuries of skin and eyes. Avoid eye and skin contact with un-screened products. Use them just in a closed environment, which protects the user against radiation.

- It is highly unlikely that a lamp break has impacts on your health. If a lamp breaks, air the room for 30 minutes and remove the broken pieces, preferable with cut resistant gloves. Put them into a sealed plastic bag and take them to the local recycling station. Do not use a vacuum cleaner.

8 Commissioning

8.1 Preliminary steps

- Clean thoroughly the AHU and all components of dust, swarf and other debris.
- Remove all loose parts like tools, 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. Not mounted filters can overload the fan motor.
- All cables must be checked for damage to the insulation and replaced if necessary.

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 that the screws of variable pulleys are tightened – refer to **Figure 200**, tightening torque depends on the type of bush, according to **Table 9.**

	Socket	1108	1210	1215	1610	1615	2012	2517
	Nm	5,7	20	20	20	20	32	50

Table 9: Tightening torque for variable pulleys

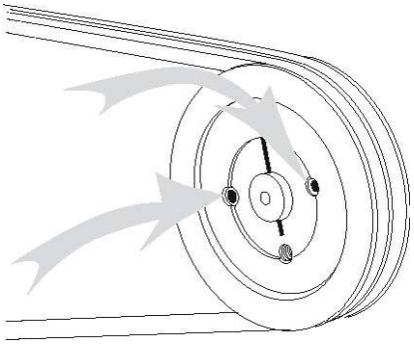


Figure 199: Fixing screws

- Check the tension of the belt and the alignment of the pullies, refer to **chapter 9.2.5 (Re-tensioning of belts)**.
- 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 Variable frequency controlled drives (frequency converter) - parameters

The frequency converter must be configured, if not done by TRANE (please refer to technical data sheet): parameterization using the following **Table 10** respectively the provided manufacturer's operating instructions and data from TRANE technical data sheet.

- Observe safety instructions of **chapter 2.1 (Indications for minimizing specific hazards)** and safety instructions of manufacturer (supplied by TRANE).
- Observe safety instructions of fan manufacturer (supplied from TRANE) regarding fan minimum starting up time. Otherwise fatigue fracture of impeller may occur.

Parameters for Danfoss frequency converter FC102

Nr.	Description	Value	Note
0-...	**Display**		
0-01	Language	[1] German	[0] English, [5] Italian
0-02	Switching between Hz/rpm	[1] Hz	Display in Hz or rpm
0-20	Display line 1.1	[1601] Setpoint [unit]	
0-21	Display line 1.2	[1610] Power [kW]	
0-22	Display line 1.3	[1614] Current [A]	
1-...	**Motor/load**		
1-00	Control type	[0] Speed control	
1-03	Torque behavior of load	[3] Auto energy optimization VT	
1-20	Motor nominal power	... kW	According to motor nameplate
1-22	Motor nominal voltage	... V	According to motor nameplate
1-23	Motor nominal frequency	... Hz	According to motor nameplate
1-24	Motor nominal current	... A	According to motor nameplate
1-25	Motor nominal speed	... rpm	According to motor nameplate
1-90	Thermal motor protection	[2] Switch off of thermistor	Connect PTC/Clixon
1-93	Thermistor connection	[2] Analog input 54	Connect thermistor to 50/54
3-...	**Setpoints/ramps**		
3-02	Minimum setpoint	15 Hz	
3-03	Maximum setpoint	... Hz	According to AHU data sheet Max[Hz]=max speed [rpm]/nominal speed [rpm]*50[Hz]
3-15	Variable setpoint 1	[1] Analog input 53	
3-16	Variable setpoint 2	[0] Disabled	
3-17	Variable setpoint 3	[0] Disabled	
3-41	Speed increase after start 1	30 s	
3-42	Speed decrease after stop 1	30 s	
4-...	**Limits/Warnings**		
4-10	Motor rotation direction	[0] Only clockwise	
4-12	Minimum frequency	15 Hz	
4-14	Maximum frequency	... Hz	According to AHU data sheet Max[Hz]=max speed [rpm]/nominal speed [rpm]*50[Hz]
4-16	Torque limit	110 %	
4-18	Current limit	110 %	
4-50	Warning low current	0 A	
4-51	Warning high current	... A	Nom. current according to motor plate
5-...	**Digital inputs/outputs**		
5-10	Clamp digital input 18	[8] Start	Start command clamp 12/18
5-11	Clamp digital input 19	[0] Without function	
5-12	Clamp digital input 27	[2] Motor coast (inv)	Bridge 12/27 necessary for operation
5-13	Clamp digital input 29	[0] Without function	
5-14	Clamp digital input 32	[0] Without function	
5-15	Clamp digital input 33	[0] Without function	
5-40	Relays 1 [0]	[5] Motor rotates	
	Relays 2 [1]	[2] Ready	
6-...	**Analog inputs/outputs**		
6-01	Dropout of signal function	[0] Off	
6-10	Clamp 53 minimum voltage	0.00 V	
6-11	Clamp 53 maximum voltage	10.00 V	
6-14	Clamp 53 minimum frequency	15 Hz	
6-15	Clamp 53 maximum frequency	... Hz	According to AHU data sheet Max[Hz]=max speed [rpm]/nominal speed [rpm]*50[Hz]
6-17	Clamp 53 signal error	[0] Disabled	
	Connections control cables:		
	PTC/Clixon	Clamp 50 and 54	50=+10V, 54=analog input 2
	Start	Clamp 12 and 18	12=+24V, 18=digital input
	Release	Clamp 12 and 27	12=+24V, 27=digital input

Table 10: parameters for Danfoss frequency converter FC102

8.1.2 Airflow measurement by differential pressure measurement at the fan

If the fan is provided with pressure test points for airflow measurement and black test points are provided on the outside of the fan unit (accessories are indicated on the technical data sheet), then a differential pressure signal can be taken.

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:

<table>
<tr><th>Formula A</th><th>Formula B</th></tr>
<tr><td>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.</td><td>In this formula, a variable air density is not taken into account.
Instead, a "fixed" air density of 1.20 kg/m³ is assumed.</td></tr>
<tr><td colspan="2">With the following formulas, the airflow rate can be determined from the pressure signal:</td></tr>
<tr><td>- Airflow rate calculation
$\dot{V} = K_A \cdot \sqrt{\frac{2 \cdot \Delta p_w}{\rho_V}}$
$\dot{V}$ Nominal airflow rate m³/h
K_A K_A –factor for formula A m²*s/h
Δp_w Measured diff. pressure Pa
ρ_V Air density at the fan kg/m³</td><td>- Airflow rate calculation
$\dot{V} = k_B \cdot \sqrt{\Delta p_W}$
$\dot{V}$ Nominal airflow rate m³/h
k_B k_B –factor for formula B m³/(h*Pa^{0,5})
Δp_w Measured diff. pressure Pa</td></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td colspan="2">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):</td></tr>
<tr><td>- Target differential pressure calculation
$\Delta p_{w.set} = \frac{\dot{V}^2 \cdot \rho_V}{K_A^2 \cdot 2}$
$\Delta p_{w.set}$ Target differential pressure Pa
$\dot{V}$ Target airflow rate m³/h
K_A K_A –factor for formula A (s.a.) m²*s/h
ρ_V Air density at the fan (Nominal value) kg/m³</td><td>- Target differential pressure calculation
$\Delta p_{w.set} = \frac{\dot{V}^2}{k_B^2}$
$\Delta p_{w.set}$ Target differential pressure Pa
$\dot{V}$ Target airflow rate m³/h
k_B k_B –factor for formula B (s.a.) m³/(h*Pa^{0,5})</td></tr>
</table>

Table 11: Formulas for airflow rate measurement

For entry into a display or control unit, please check whether this is programmed according to formula A or formula B and enter the corresponding value K_A or k_B.

The corresponding K-factors of the fan are shown in 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.
The air density at the measuring point is to set up manually, depending on sea level, temperature and humidity. In most cases, 1.2 kg/m³ is a suitable value.

Note: If in the TRANE delivery a device for airflow measurement is included, then this must be configured on site and this is responsibility of the client before, commissioning!

Airflow rate indicator type PREMASREG 7161
This airflow indicator is used by TRANE and is supplied with the AHU, if included in the scope of delivery. The setting of the parameters must be made by the customer before commissioning. This means, it is the client's responsibility to complete this task in accordance with the enclosed instructions of the manufacturer.
The display is programmed according to formula B. Correspondingly, the value kB specified on the data sheet in the fan section or the technical data sheet for the AHU must be used.

If more than one fan is installed in the supply or exhaust air, then the following instructions must be observed:

Fan execution	Displays in pcs.	Measuring points	Total air flow rate
2 fans 50 % + 50 %	1 display	Only the fan nearest to the operating side	Displayed value * 2
2 fans 100 % + 100 %	2 displays	Both fans separately	Displayed value (powered fan)
>2 fans/fan walls	1 display	Only the fan nearest to the operating side	Displayed value * number of powered fans)

Table 12: Notes for airflow rate indicators, which are included in the scope of delivery

Processing the pressure signal in other devices
Devices from other manufacturers may require a conversion of the K-value. Therefore, always ask for the formula, which the device is using.

8.1.3 Heat exchanger

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

Attention!
Refrigerant
If direct expansion heat exchangers or air cooled heat exchangers are installed, the system must be filled with refrigerant after the complete assembly. In this case, a refrigeration engineer must execute the installation and piping.

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.
- Water valve is to open fully, start the fan.
- Subsequently, the entire piping system must be vented properly.

Steam heat exchanger filling
- Open vent and drain valve on the condensate drain.
- Open the steam valve only slightly at the beginning, until steam is coming out of the drain and vent valve (on the condensate drain outlet).
- Close drain and vent valve and open steam valve fully.
- Check regularly the vent valve during operation.

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

8.1.4 Electric heater

Observe specifications of **chapter 7.6 (Electric heaters)** -safety thermostats.

Caution with electric heaters that are located near to a honeycomb humidifier: The material of the honeycombs is only resistant to a temperature of max. 60 °C. Start the heater only with running fan – heat removal!

8.1.5 Air filters

- Before the commissioning, all filters should be checked for tightness, as otherwise they could be sucked in and could lead to damage.
- Differential pressure measuring devices - U-tube manometer and inclined manometer- are optional and must be filled with the supplied test liquid (bottle) of density 1 kg/l.
- If a differential pressure switch is mounted (option) or is it installed on site, then it is to set to the final pressure drop. Information regarding final pressure drop can be found at the technical data sheet.
- In addition, the output of a warning message when the final pressure loss is reached must be ensured during the commissioning. The resulting maintenance actions are described in **chapter 9.3** (**Air filters**).

8.1.6 Humidifier / Air washer

8.1.6.1 General indications

Drain pans must be cleaned thoroughly. Pollution from construction dust can cause failure of the pump. In this case, there is no warranty.

Attention! Never operate the pump running dry, running against a closed discharge valve is permitted, operating against a closed shut-off value should be avoided, otherwise there is danger of overheating.

- Check the pump rotation direction (arrow on the pump). Measure the current consumption. Compare the values with the data on the nameplate.
- The water pressure for the water supply should be 3.0 bar. Maximum allowable pressure is 6.0 bar.
- Check the tightness of the flange connection of the humidifier to the adjoining components. If necessary, reseal.

8.1.6.2 Spray humidifier

- Fill pan and U-trap with fresh water and adjust float valve so that valve closes with a water level 2-3 cm below the overflow. Ensure in any case, bubble-free suck in.
- Open the valves on the pump pressure side and suction side (where applicable) completely.
- Check the tightness of all tube connections. Retighten the clamps using a torque wrench. Fix the screw with a torque of 5….6,5 Nm.
- Start the pump and re-check all tube connections for tightness. Repeat this check after 10 hours of operation.
- When pump is running at nominal RPM, check the manometer on the pressure side. The water pressure at the manometer should be 2.5….3.0 bar – if necessary close pressure side valve accordingly.
- Check pump strainer, washer nozzles and tubes for proper fit.
- Check humidifier strainer and clean it if necessary.

8.1.6.3 Evaporative humidifier

General indications:

- Check the proper installation of the PVC fins and droplet eliminator. The arrow must point in direction of airflow (**Figure 201**).
- Fins made from cellulose material can have initially an odor that is normal and will soon disappear.

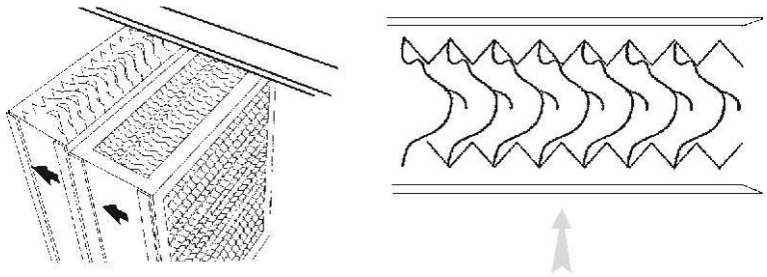


Figure 200: Installation of honey comb and droplet separator packages

Circulation water operation

- The blowdown quantity is to be setup manually at the tacosetter.
  Recommended setting (thumb): Bleed off rate = evaporation rate
- Ensure that the pump impeller is completely covered by water. The water level must be regulated by the maximum and minimum level switch.
- Furthermore, it must be ensured by the control, that the designated conductivity, see **Table 5**, will not be exceeded. If the limit is reached, the blowdown valve must be opened.

8.1.6.4 High pressure spray humidifier

If no commissioning of the high pressure spray humidifier is agreed with TRANE, the manufacturer of the component must be contacted directly.

8.1.6.5 Steam Humidifier

The indications of the manufacturer of the steam humidifier must be observed for the commissioning.

8.2 Refrigeration circuit

8.2.1 General notes

- Refrigeration equipment is subject to the EG Pressure Equipment Directive (2014-68-EG) and requires special handling and special care.
- Start up the refrigeration circuit only if it was properly installed, evacuated and filled - Never start a compressor under vacuum.
- It is essential that the glide of refrigerant blends as R407C is carefully considered when adjusting superheat controls.
- Air inlet and thus the entry of humidity into the refrigeration circuit must be avoided rigorously, since the refrigerant oil is highly hygroscopic. The water, which is absorbed by the oil, cannot be removed sufficiently.

8.2.2 Manually starting the compressor via TRANE control system

The compressor can be started via the display of the TRANE control system as follows:

1. Start page → *All Settings* → *Password handling* → Enter the password
   Note: Manually starting the compressor can only be performed at service level (Password level 4; key symbol: 2 keys). The 4-digit password for the service level is *6975*.
2. Start page → *All Settings* → Inputs/Outputs → *Digital outputs* → *Compressor 1 (/ Compressor 2 / Compressor 3)* → *Manual intervention* → *On*

8.2.3 Refrigerant

Refrigerants used by TRANE are halogenated hydrocarbons, preferably R407C and R134a. These are also known as safety refrigerants (safety group A1 according to EN378 part 1) in contrast to flammable refrigerants such as Propane or toxic refrigerants such as Ammonia.
They are actually non-flammable under normal operating conditions and do not create explosive mixtures with air, but are odorless. Only higher concentrations in the air can be noted by the olfactory sense.

Refrigerant vapors, which escape from leaking cylinders or refrigeration plants, will be mix undetected with air and therefore the risk of suffocation arises with concentration through the displacement of the breathing of essential oxygen. Humans are not able to detect oxygen deficiency with their senses. As refrigerant vapor is heavier than air, they concentrate at ground level and in lower-lying areas of the building. In order to avoid the occurrence of higher concentrations, workplaces must always be ventilated well.

Halogenated refrigerants can also have narcotic effect. In case of high refrigerant concentration (e.g. tube leakage) the technical room, the room must be evacuated immediately. Enter only after adequate room ventilation occurs.

If the room must be entered during high refrigerant concentrations, then a breathing apparatus that is independent from the ambient air must be used. Furthermore, such a breathing apparatus can only be used by specially trained and medically suitable people or other professionals.

8.2.4 Compressor lubricant

- Compressor oil, a synthetic ester oil, is highly hygroscopic, so that the bound moisture in the oil cannot be completely removed by the evacuation of refrigeration circuit.

- Air entering in the system is to avoid strictly!
- For R407C and R134a scroll compressors use Emkarate RL 32 3MAF oil.

8.3 Test run

After having done the preparatory work the AHU can be started for the test run.
- For testing the device and 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, because by eliminating the system-side pressure drop measurement errors will be the result.

Before starting the fan open the dampers! Fan may not run against closed dampers.

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 is maybe a faulty connection. 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.
- e.g. closed fire or VAV dampers in the duct

8.3.1 Adjusting variable pullies

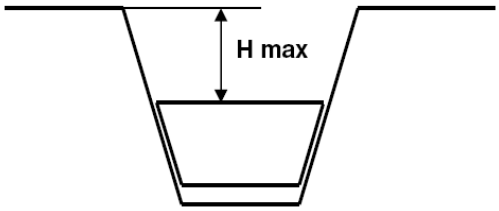


Figure 201: Smallest working diameter

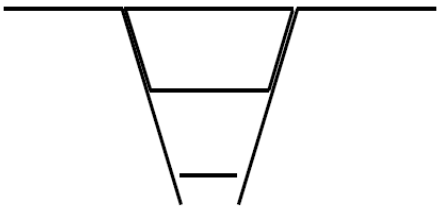


Figure 202: Biggest working diameter

Belt type	Pulley type	Min. working diameter (mm)	H max. (mm)	Max. working diameter (mm)
SPZ	RST 84	62	9	80
	RST 95	73	9	91
	RST 100	78	9	96
	RST 108	90	7	104
SPA	RST 108	76	13	102
	RST 120	88	13	114
	RST 129	97	13	123
	RST 139	109	12	133
	RST 146	116	12	140
	RST 156	126	12	150
	RST 164	134	12	158
	RST 177	149	11	171
	RST 187	159	11	181

SPB	RST 156	117	19	149
	RST 164	125	19	157
	RST 178	139	19	171
	RST 187	148	19	180
	RST 200	161	19	193
	RST 250	211	19	243

Table 13: Data of pulley types

Changing the working diameter of a variable pulley:

1. Decrease the belt tension.
2. Open the over the disk circumference distributed screws (position see **Figure 205**)
3. Twist the outer ring (the outer rings for pulleys with 2 slots) to the desired diameter, observe the limits as per **Figure 202** and **Figure 203**.
4. Fix the Allen screws.
5. Tighten the belts (refer to **chapter 9.2.5 (Re-tensioning of belts)**).

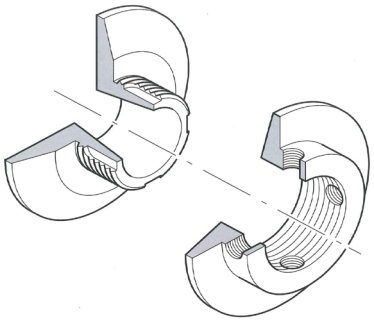


Figure 203: Schematic structures of a variable pulley

Figure 204: Position of the Allen screws on variable pullies

After a change of the transmission ratio, the current consumption of the motor must be controlled in each case. If the consumption is too high, the effective diameter has to be adjusted again. The nominal current shown on the nameplate must not be exceeded.

Determination of frequency converter caused problems

You can determine whether or not problems are caused by the frequency converter by connecting the fan motor directly to mains power supply. Most commercially available frequency converters have a feature to address these problems.

If the airflow is incorrect and if you require support on this matter, please contact TRANE.

8.3.2 Vibration verification

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

On commissioning of the AHU, a vibration measurement and / or resonance frequency search in the entire speed control range must be carried out and recorded in the acceptance report.

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 206** shows a typical vibration curve.

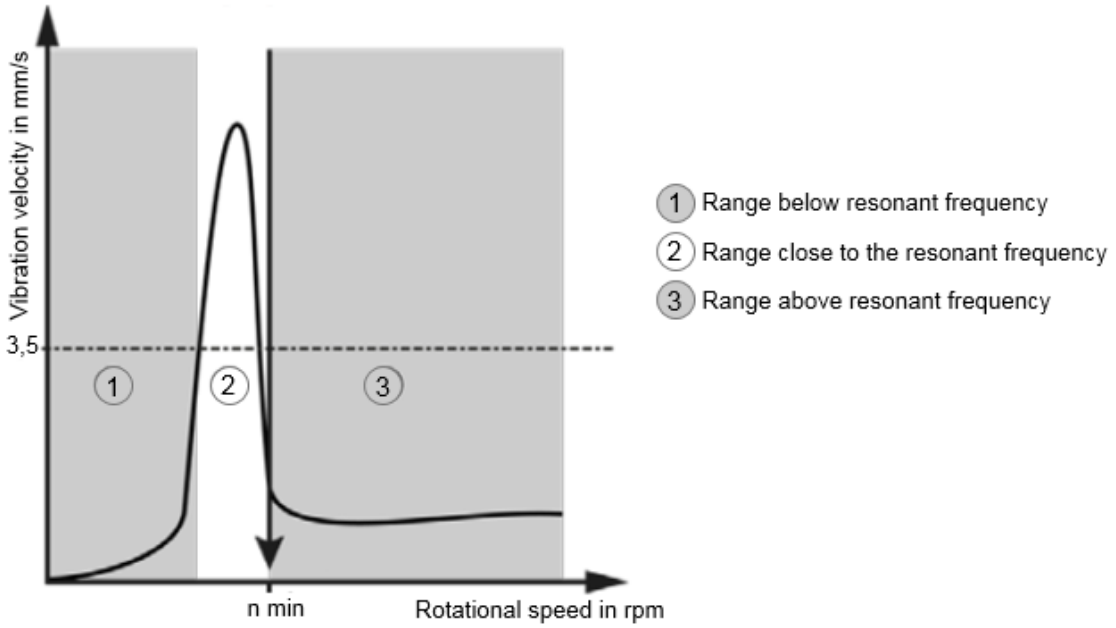


Figure 205: Typical vibration curve

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

In partial load, operation it could be that the operating point may coincide with the resonant range. In such situations, this operation must be prevented on site by 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 TRANE control, the resonant range can be suppressed. For that purpose, the appropriate setting in the software must be done at the commissioning process.

Permanent operation of fans at inadmissible high vibrations can lead to severe damage at the AHU and subsequently to damages to property or personnel.

9 Maintenance

TRANE AHUs are built mostly maintenance free and easy to maintain when required. The maintenance intervals (see **Table 18**) are indicative for normal operating conditions. Widely differing applications may require different intervals, ask TRANE for details. The execution of the described checks and maintenance needs are necessary to ensure a permanent safety operation and functionality of the AHU.

The entire AHU and all components must be checked regularly for pollution, corrosion, damage and fixing and, if necessary, they must be cleaned or repaired.
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.

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

Please note that we are not responsible for damage caused by improper handling of solvents and cleaning agents, and we would not be liable for mechanical damage. Solvents and cleaning agents may not contain alcohol for use on coated surfaces.

In order to avoid corrosion, in the case of components made of stainless steel like drain pans or bases, ensure that fragments of carbon steel laying around are removed and stainless steel parts are cleaned from swarf of carbon steel.

To order spare parts please contact your TRANE sales partner.

TRANE recommends, depending on the specified AHU execution, performing checks, maintenance and repair work in compliance to the specifications according to VDI 6022 sheet 1, requirements regarding operation and maintenance.

9.1 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 and eliminated immediately.

The following maintenance work is recommended for the control cabinet of AHUs with integrated control:
- annual change of the filter
- annually check the function of the fan for the control cabinet ventilation (if present)
- annually check the function of the heater (installed in outdoor AHUs)
- annually check of screw connections and electrical connections and if necessary retighten
- cleaning of possible dust deposits

9.2 Fan / motor group

9.2.1 Vibrations

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

During operation of the AHU, an excessive vibration level can occur due an unfavorable air flow, accumulation of dirt and dust, missing 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 manufacturer's specifications, and the results must be recorded. The maximum vibration speed according to the manufacturer's specifications must be strictly observed. If the admissible vibration values are exceeded, it is absolutely necessary to identify the cause and take immediately appropriate measures.

9.2.2 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 vibration isolators for proper mounting through damage (visual inspection).
- Check the protection grid (Fan in and/or outlet) if available for correct installation / damaged (visual inspection).
- Check the drain (if available) for functionality.
- Test the wheel by rotating it by hand for abnormal noises.
- Rotate the wheel by hand and check for strange bearing noise.
- Renew both bearings if there are irregular or rough noises.
- The theoretical lifetime, depending on the operating conditions, is at least 20,000 hours.
- The fan bearings are lubricated for life. Except the pillow block bearings of larger fans, with demanding operating conditions, should be lubricated annually in accordance with **Table 14** below and this should be done with lithium soap grease (see **Table 15**) for recommended grease types. After three lubrications the bearings must be removed, cleaned and greased again.
- After dismantling and reinstalling an impeller, the fan must be checked for mechanical vibrations. It may be necessary to rebalance.

Ambient conditions	Temperature range °C	Lubrication interval
Clean	T < 50	6 - 12 month
	50 < T < 70	2 - 4 month
	70 < T < 100	2 - 6 weeks
	100 <	1 week
Dusty	T < 70	1 - 4 weeks
	70 < T < 100	1 - 2 weeks
	100 < T	1 - 7 days
Extreme humidity		1 week

Table 14: Lubrication intervals for fan bearings

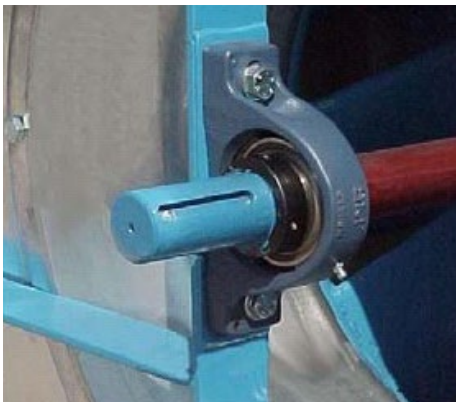


Figure 206: Fan bearing with grease nipple
(example Comefri NTHZ)

Supplier	Type	Basis	Temp. range
FINA	Marson HTL 3	Lithium	30 °C / +120 °C
SHELL	Alvania Fett 3	Lithium	-20 °C / + 130 °C
ESSO	Beacon 3	Lithium	-20 °C / + 130 °C
MOBIL	Mobilux EP3	Lithium	-30 °C / + 130 °C

Table 15: Recommended grease types

Plug fan

- The fan is directly flanged to the motor and due to the absence of the belt drive it is a service friendly component.
- To reach the operating point, a frequency converter is required.
- Danger: Deposits on the wheel can cause damage (risk of fatigue fracture) and the impeller can break!
- Visual inspection: Check the wheel for any particular weld cracking.

9.2.3 Motor

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

Motor bearings

- In case of irregular or unusual sounds, the corresponding bearing must be replaced.
- Small and medium sized motors are equipped with closed bearing, running for several years without the need of lubrication.
- Bearings of larger motors, depending on the motor manufacturer and motor size, are equipped with nipples for lubrication. For exact details and information regarding grease type and quantity for lubrication, please refer to operating instructions of the motor manufacturer. After three re-lubrications, the bearings must be dismounted, cleaned and greased again. For lubrication intervals under normal operating conditions and 24 h/day load refer to **Table 16**.

Size	2-pole 3000 1/min	4-pole 1500 1/min	6-pole 1000 1/min	8-pole 750 1/min
bis 180	12	12	12	12
bis 250	6	12	12	12
280	3	12	12	12

Table 16: Lubrication intervals for motor bearings (in month)

- For different, unfavorable operating conditions, the intervals are to be reduced according to the motor manufacturer's instructions.
- Recommended grease types for the relubrication of motor bearings can be taken from **Table 15 chapter 9.2.1**

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

During operation of the AHU, an excessive vibration level can occur due an unfavorable air flow, accumulation of dirt and dust, missing 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 manufacturer's specifications, and the results must be recorded. The maximum vibration speed according to the manufacturer's specifications must be strictly observed. If the admissible vibration values are exceeded, it is absolutely necessary to identify the cause and take immediately appropriate measures.
-

9.2.4 V-belt drive

The V-belt drive is a reliable, low-maintenance component, provided that unfavorable working conditions as shown in **Figure 208** up to **Figure 211,** which could reduce durability and result in reduced efficiency. The unfavorable conditions include high temperatures and inadequate filtered air and thus formation of deposits.
- Check V-belt drive for dirt, damage, wear, tension and alignment (visible inspection)**.** Belts with damages like cracks or frayed edges must be replaced.
- Pullies must be checked for fitting, wear and damage.

Reasons for increased belt wear or defect
- Belt contact the groove bottom / unequal set of belt / tension is too high or too low – **Figure 208**

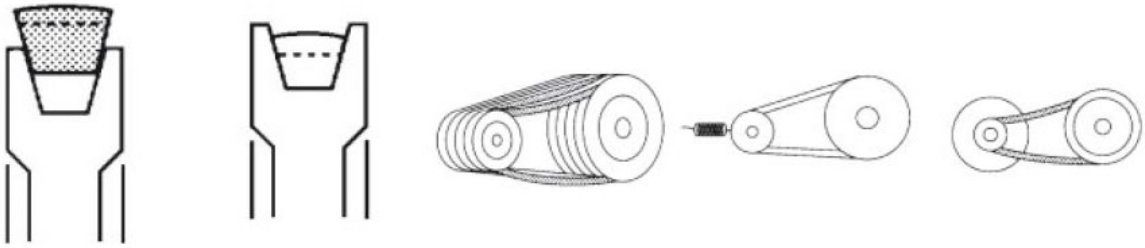


Figure 207: Unfavorable operating conditions (1)

- Slippage / pulley too small / overloading / damaged disc / eccentricity, wobble – **Figure 209**

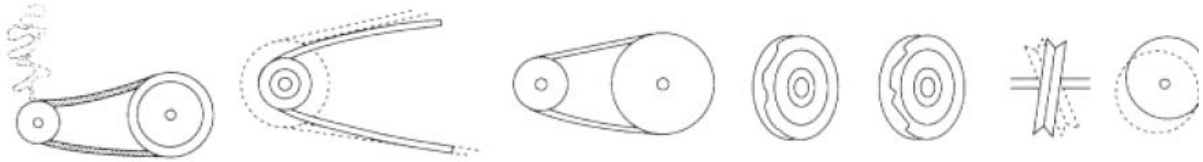


Figure 208: Unfavorable operating conditions (2)

- Disc worn / grooved not uniform / dust, dirt / moisture, humidity – **Figure 210**

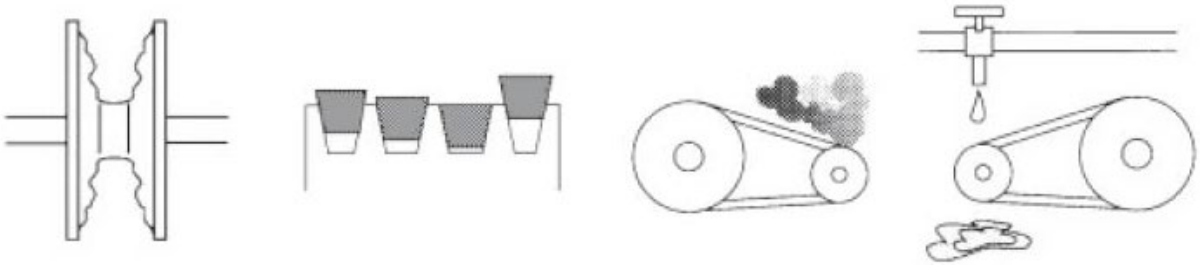


Figure 209: Unfavorable operating conditions (3)

- Alignment / offset wheels / non-parallel plates / discs rotated to each other – **Figure 211.**

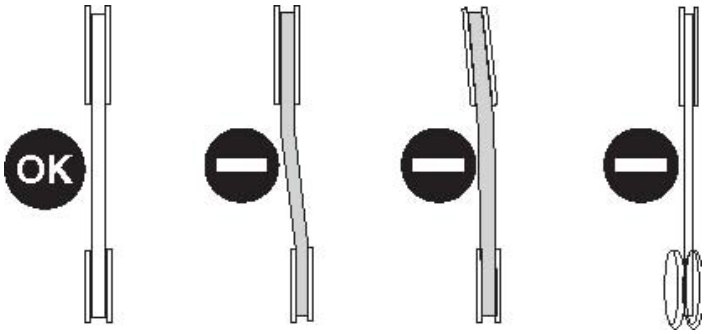


Figure 210: Unfavorable operating conditions (4)

9.2.5 Re-tensioning of belts

Moving the motor away from the fan adjusts the tensioning of the belt.
Depending on the size of the motor is this:
- On a rocker swivel
- On rails moveably mounted.

Loosening the lock nut and then turning the adjustment screws make the necessary adjustment. It is important to maintain the alignment of the discs accordingly – **Figure 212** and **Table 17.** This should be checked after each tensioning with a straight edge.

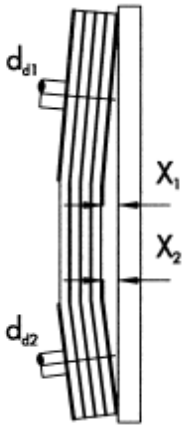


Figure 211: Adjustment of pullies

Pulley diameter d_{d1}, d_{d2} in mm	Max. distance x_1, x_2 in mm
< 112	0,5
< 224	1
< 450	2
< 630	3

Table 17: Maximum deviation at adjustment of pulleys

For quick results during the pulley alignment for factory mounted pullies, we recommend setting the same protruding thread size of the threaded rods on the left and right side shown in **Figure 213**.

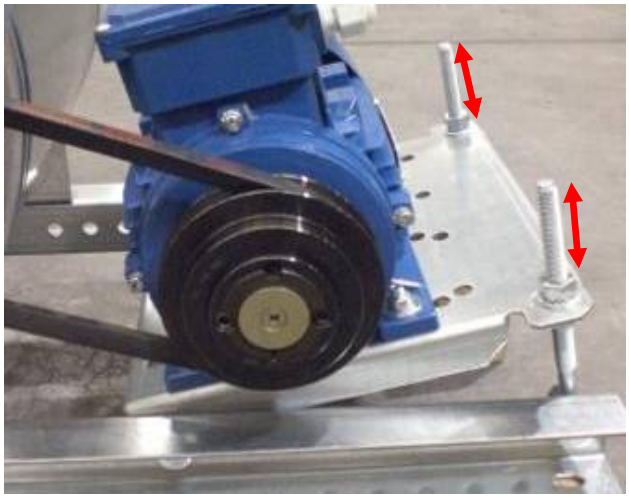


Figure 212: Adjustment of pulleys via threaded rods

In case of various pulley widths, the gap must be equal on both sides.
The belt drive is to be re-tensioned, after the first 10 operating hours.

Belt tension
The correct tension of the belt is obtained through adjustment in compliance with the tensioning data, which is calculated separately for each drive. The necessary information to tension new and used belts can be found on the tensioning data sheet, which see sample in **Figure 214**.

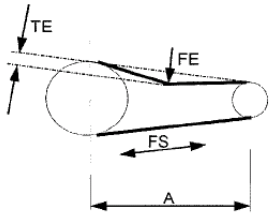
BELT TRANSMISSION AND TENSIONING DATA

Supply air

fan type:	**Nicotra/Gebhardt / RDA E6-0500**			motor type	**ELVEM 6XM 132S-4**
revolutions:	**1.724**	1/min		revolutions:	**1.450** 1/min
fan shaft power:	**3,82**	kW		motor shaft power	**5,50** kW
fan pulley:	**1 SPB 160**			motor pulley:	**1 SPB 190**
pulley work diameter:	**160,0**			pulley work diameter:	**190,0**
fan bush	**1610-40**			motor bush	**2012-38**
belt section					**1 x SPB - 2.000,0**
axle distance		A	[mm]		**725,0**
				NEW BELTS	USED BELTS
static tension per belt strand		FS	[N]	**295,0**	**226,9**
deflection force		FE	[N]	**75,0**	**75,0**
deflection under deflection force		TE	[mm]	**27,0**	**20,8**
frequency of tended belt		f	[Hz]	**28,0 [+-10%]**	**24,0 [+-10%]**

AMPERAGE
-- measure motor amperage during commissioning
-- for max. motor current see motor type plate

BELT TENSIONING
-- check belt tension after the first 10 hours of operation
-- respect the above mentioned tensioning date
-- use measuring instrument for check
-- check periodically the belt tension
-- maintain unit according to service handbook



ATTENTION: OVERTENSIONED BELTS CAN CAUSE EXPENSIVE SUBSEQUENT DAMAGES
MODIFICATION OF BELT TRANSMISSION ONLY WITH WRITTEN CONFERMATION BY EUROCLIMA

IMPORTANT FREQUENCY CONTROLER PARAMETERS

nom. freq. [HZ]	**50,1**	max freq. [Hz]	**77,0**	max. current [A]	**10,9**

Figure 213: Belt transmission and tensioning data sheet

Following two methods to determine the tensioning are described:
Force-way measurement
The information
- Test force FE
- Indentation depth TE
- Statistical belt tension (belt tension), FS

The belts are to be tensioned so that the deflection TE is when the belt is loaded with the test load in point FE (such as with a spring balance). Alternatively, you can check the static belt tension FS directly with special belt tension measuring instruments.

Frequency Measurement
Special measuring instruments that are based on frequency measurements are available on the market. Tension the belt in a way, that during the measurement you measure the same frequency as indicated on the fan data sheet.

9.2.6 Replacing of belts

- Loosen the belt tension to ensure that the old belt can be removed.
- Clean components before putting on the new belt pullies and check for damage and wear.
- Never push the new belt with a tool onto the pulley in order to avoid damage which can shorten the lifetime of the belt.
- On multi-groove pullies, all belts must be replaced simultaneously.
- Ensure that the belt number coincides with the number of pulley grooves.
- When tensioning the belt on multi-groove drives, ensure that all belts have their loose side on the same side otherwise they can become damaged (see **Figure 215**).

Figure 214: Multi-groove pullies – attaching the belts

- Tension the belts, give the drive a few turns with no load and re-measure the belt tension.
- Check axle and wheel alignment, see **chapter 9.2.5** (**Re-tensioning of belts**).
- Repeat these steps until alignment and belt tension are correct.

9.3 Air filters

TRANE 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.

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. Please view the technical data for getting this information (**Figure 216**).

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 215: extract (filter section) of technical data

All filters should be checked for tightness, because otherwise they could be sucked in and could lead to damage.

If AHUs are equipped with TRANE control, then a corresponding warning message is displayed on the HMI (see **Figure 217**) when the differential pressure limitation is reached.

Figure 216: Warning message filter

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

9.3.1 Panel filters

Dry panel air filters (cleanable). 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.

9.3.2 Bag filters

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.

9.3.3 HEPA filters

- Contamination level of the filter can be controlled by the differential pressure drop (check every 14 days to 1 month), therefore replace the filter if necessary.
- Check filter sealing and fastening. The filter clamps must be tightened evenly. Tighten the clamps clockwise in two stages.

9.3.4 Activated carbon filters

If saturation is reached (expiration of the designated operation hours), the activated carbon cartridges must be changed. Proceed as followed:

1. Release cartridge from base plate (bayonet fastening).
2. Insert and fix a new filter cartridge.
3. Check tightness of the filter.

9.4 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 considered for cleaning works.

9.4.1 Medium water / steam

Special maintenance for heat exchangers is not required, only occasional 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.

Cleaning
Cleaning is to be carried out on the mounted state with a strong vacuum cleaner from the dust airside. For strongly adhering dust, the heat exchanger can be dismounted and cleaned with water. Galvanized steel coils can be cleaned with a steam cleaner or by washing the fins with a strong water jet. You could take a soft brush to help, but do not damage the fins.

The fins of copper-aluminum heat exchangers are particularly sensitive, therefore, use 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 for the correct setting.

Drain pan
Drain pan and drain should be checked for debris and cleaned, if necessary – **Figure 218**.

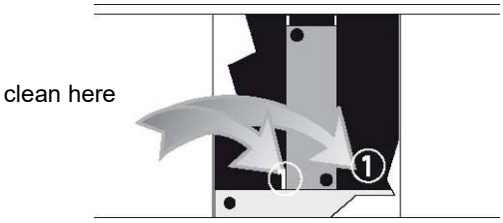


Figure 217: Cleaning of air coolers

Droplet eliminator
Check the droplet eliminator about once per year for contamination. Remove fins and clean if necessary. Please make sure that the fins are installed properly and are not bent.

Pollutants can cause poor performance of the AHU as well as damage due to drop flight.

Steam Coil
Check automatic vapor supply stop and automatic fan run for some minutes, after the AHU is shut down.

9.4.2 Refrigerant

For the medium refrigerant (direct evaporator or condenser coil) the same actions apply as described in **chapter 9.4.1** (**Medium water / steam**). For additional actions to be taken see **chapter 9.11** (**Refrigeration circuit**).

9.4.3 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.

9.5 Humidifiers

9.5.1 General indications

The instructions of **chapter 8.1.6.1** are to be applied analogously.
The following instructions are generally stated and apply as far as the respective component is available in the present humidification system.

- The maintenance of pumps and motors must be done according to the manufacturer's instructions.
- Regular cleaning of all components largely determines the hygiene of the entire system.
- When unused for long periods, the water must be released for hygiene reasons and the drain must be cleaned properly. Drain the pump as well.
- Fill siphon with clean water.
- Depending on water pollution, water hardness and water treatment, impurities and lime deposits must be removed from the washer: Severe calcification of components such as nozzles and droplet eliminators indicate an insufficiently effective water treatment. Calcification of nozzles and droplet eliminators can be removed by treatment with dilute formic acid. After treatment, rinse well with clean water. Calcifications at droplet eliminators and straighteners made of PPTV may be removed through slight bending of the fins after drying and dismantling of respective components.
- Replace corroded or damaged droplet eliminator fins.
- Check sieves and strainers for dirt deposits and clean if necessary.
- Check outlet, overflow, U-trap and water tank for debris and clean if necessary.
- Check solenoid valves for functionality and clean if necessary.
- Check control and safety devices for functionality.

9.5.2 Spray humidifier

The instructions of **chapter 9.5.1** are to be applied analogously.

- Check water supply for proper function and check the water level, if necessary, adjust the float valve so that the valve closes at a water level of 10 – 15 mm below the overflow.
- Disassemble and clean the nozzles.
- Damaged nozzles are to be replaced. Never clean the nozzle holes with hard objects. Clean the nozzle holder without nozzles with high-pressure water. Make sure that the drain valve is open while doing this process.
- Check pump piping for leaks.
- Check the hose clamps for proper fit.
- Check the flexible tube connections in the air washer circuit on fissures and for damages every three months. In the case of visible damages, cracks in the surface, signs of aging or deterioration, the flexible tubes must be substituted immediately.
- Substitute flexible connector tube on pressure side and suction side every 5 years.

9.5.3 Evaporative humidifiers

The instructions of **chapter 9.5.1** are to be applied analogously.

- The float valve has to close securely at a water level of 15 – 20 mm below the overflow to ensure bubble free suction. Possible readjustments have to be performed in the course of any regular inspections.
- Heavily calcified evaporative modules must be renewed.

- In mild calcification the packet can be cleaned by adding decalcifier to the circulating water (shut down the AHU before adding decalcifier). After that, clean the section and tubes properly with fresh water.

9.5.4 High pressure humidifiers

Carry out the maintenance according to the instructions of the manufacturer.

9.5.5 Steam humidifiers

Carry out the maintenance according to the instructions of the manufacturer.
Additionally, the instructions of **chapter 9.5.1** are to be applied analogously as well as following issues:

- Check steam distribution for deposits.
- Check steam supply for leaks.
- Check function of the condensate drain.
- Check electrical contacts of the pump for corrosion.
- Measure the current consumption.
- Clean entire piping system, control and safety devices.
- Measure the humidifier performance after maintenance.

9.6 UV section

The UV section has to be checked and cleaned regularly. Broken lamps have to be replaced before the next commissioning. Avoid direct contact with the lamps.

9.7 Dampers

TRANE 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, tighten the screws if necessary.

9.8 Sound attenuators

Acoustic baffles are basically maintenance-free. They must be checked for damage within major maintenance work and shall be replaced or properly repaired, if required.

9.9 Weather louver

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

9.10 Energy recovery systems

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

9.10.1 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.

The only maintenance required is cleaning:
- Clean the condensate drain, control and fill the U-trap. The plate pack is normally self-cleaning.
  - Remove fibers and dust at the exchanger inlet with a brush.
  - Clean oils and fats with hot water, household cleaners or degreasing steam.
- Check for proper operation of the differential pressure switch – for function refer to **chapter 7.7** (**Differential pressure restriction for plate heat exchangers**).
- If there is a bypass damper, please refer to **chapter 9.7 (Dampers)**.

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

9.10.2 Heat wheels

Check the drive unit according to the manufacturer's instructions.

In general:
- The construction of the storage mass is nearly completely self-cleaning.
- The rotor can be cleaned with compressed air, water, steam and grease-dissolving household cleaning products.
- The sliding seal, which seals the rotor, is to be checked and adjusted if necessary.

9.10.3 Heat pipes

Heat pipe components have no drive or moving parts, maintenance is limited to cleaning:
- Clean the drain pan and check the siphon. Fill the siphon, if necessary.
- Fins cleaned by:
  - Compressed air against the air flow direction or
  - Spraying with low pressure water, if required add household cleaning detergent.
- If bypass dampers exist, please refer to **chapter 9.7 (Dampers)**.

9.10.4 Accublocs

Electrical connection:
The accubloc is supplied including a controller supplied loosely (configured with default values), including operating instruction. On site the following must be provided:
- Power supply 3x400 V (efficiency according to technical data sheet)
- Control signal 0-10 V

All bearings are self-lubricating ball bearings or bronze bearings. These should not be re-lubricated. It is important to ensure that the sensor is about 2 mm away from the engine. This can be checked with a 2 mm thick piece of sheet metal. If necessary, the distance can be readjusted. The inner side of the sensor is accessible through the open damper with a wrench SW17.

Caution! Switch off before installation and secure against accidental reconnection.

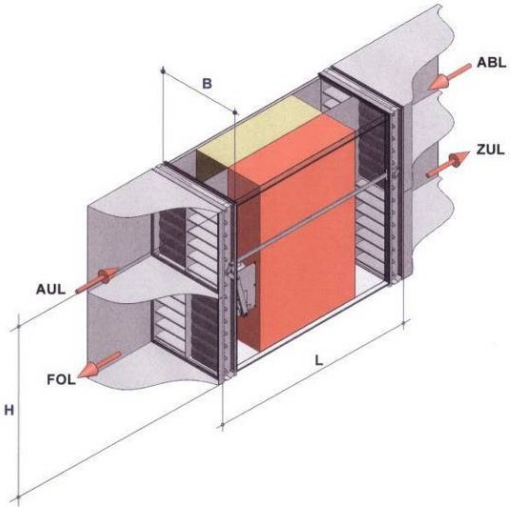


Figure 218: Scheme of an accubloc

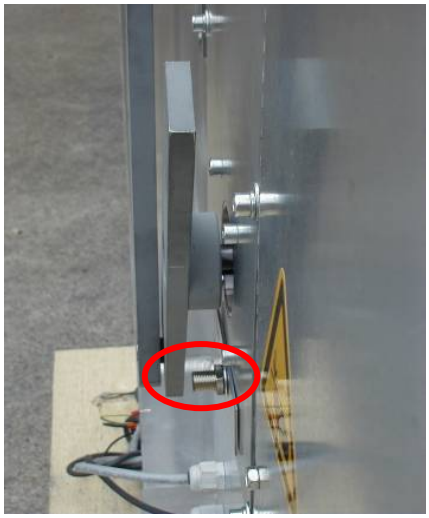


Figure 219: Position of the sensor

The only maintenance required is periodic cleaning of the memory blocs. The cleaning intervals can be defined by visual inspection.

The memory blocs are to be taken off as follows for cleaning:

1. Switch the safety switch to OFF, it must be ensured that the accubloc - control is off.
2. Dismount the AHU wall on the access side.
3. Dismount the cover sheet for the damper linkage.
4. Dismount the damper linkage.
5. Unscrew the metal cover.
6. On site an adapted devise must be mounted on the accubloc frame, which allows the extraction of the memory blocs. The device should contain a guide and an end stop, similar to the internal guide rails. **Be careful!** The memory blocs move very easily.
7. The second memory bloc is reachable when the wall between the memory blocs is pulled out. Therefore, there are two handle holes on the upper half.
8. The memory blocs could be cleaned with compressed air or with a high-pressure-cleaner. Thereby, the distance of the nozzle lance must be big enough, to ensure that the structure of the memory blocs do not get damaged. If chemical cleaning additives are used, only for aluminum suitable and non-alkaline cleaning agents are allowed.

9.11 Refrigeration circuit

To make sure that the environmental requirements are implemented and that the operational reliability and a long lifetime of refrigeration circuit is ensured, periodic leakage checks, maintenance and visible checks are required.

9.11.1 Leakage checks

- Have to be performed according to EU-regulations indicated in *Records for refrigeration circuit application in air-conditioning units* supplied by TRANE. The checks must be executed by a certified refrigeration technician. The intervals for the checks depend on the refrigerant filling quantity.

- Have to be documented in *Records for refrigeration circuit application in air-conditioning units*.

The type of refrigerant and the refrigerant filling quantity is attached on a sticker applied next to compressor.
Refrigerant contains fluorinated hydrocarbons indicated in the Kyoto Protocol with the following global warming potential (GWP = Global Warming Potential), based on CO_2 (data from EN378 part 1):
- R407C: GWP = 1650
- R410A: GWP = 1980
- R134A: GWP = 1300

The greenhouse potential and the amount of refrigerant used in the device determine the maintenance interval of the device.

Example:
Specification: refrigerant R407C, capacity 30 kg
CO2 equivalent: 1650 x 30 kg = 49500 kg = 49.5 t
Maintenance interval: 5 t ≤ 49.5 t <50 t → at least every 12

Maintenance intervals for the corresponding limits are given in **Table 18**.

9.11.2 Maintenance

- Has to be performed only by qualified personal and at least once a year.
- Has to be documented in supplied *Records for refrigeration circuit application in air-conditioning units*. Also, local regulations must be observed.

Whole system:
- Check pressures and temperatures of the system.
- Pay attention to unusual operating noises and to possible vibrations.
- Possible dust deposits around components have to be removed.

Compressor:
- When the compressor is switched on, there must be oil visible through the sight glass (if present). If oil is not visible, ensure that there has not been a loss of oil (even outside of the AHU is possible); Optionally pour oil directly by an oil pump into the compressor suction side. Only use oil that is approved by the compressor manufacturer.
- During standstill periods of the compressor operation, the compressor crankcase heater switches on in order to avoid an accumulation of refrigerant in the oil. Too much refrigerant in the oil causes a dilution of the oil, resulting in a loss of viscosity leading to reduced lubrication of all moving parts. To start the compressor manually, it has to be proceeded as described in **chapter 8.2.2** (**Manually starting the compressor via TRANE control system**).
- Follow the maintenance and inspection requirements of the compressor manufacturer. These instructions are supplied by TRANE or can be ordered from TRANE.

Filter drier:
Each refrigeration circuit is equipped with a filter drier. If the refrigeration circuit has to be repaired, the filter drier must be replaced.

Sight glass in liquid line and on receiver
Liquid line sight glass contains a moisture indicator for refrigerant, operating as follows:

Indicator green	=	dry
Indicator yellow	=	wet

If the indicator shows wet refrigerant, at least the filter drier must be changed. Further measures may be necessary.
The correct quantity of refrigerant can be checked at the operating refrigeration circuit. In both sight glasses (note: sight glass on receiver according to circuit execution not always supplied) refrigerant must be visible. The sight glass in liquid line must be filled completely.

Expansion valve:
- Check superheating of expansion valve, which should amount about 5 to 10K. Check that the temperature sensor is correctly fitted as well as the pressure compensation pipe.
- If an electronic expansion valve is used, necessary values must be entered into the corresponding controller (according to the instructions of the valve manufacturer). Instructions from the valve manufacturer are supplied by TRANE.

High pressure safety switch:
The high pressure switch stops the compressor when the allowed equipment pressure is exceeded. A functional check must be carried out during commissioning and must be performed during any during each maintenance work.

Low pressure safety switch:
The low pressure switch stops the compressor when the equipment pressure falls below the allowed low pressure limit. A functional check must be carried out during commissioning and must be performed at each maintenance work.

Handling:
If the unit goes into high or low pressure mode, the problem must be acknowledged at the control panel for the compressors to start again.

Electrical superheat controller
The electronic superheat controller has an internal battery, so that the valve closes securely even during power failures. Without this feature, the valve remains open, resulting in liquid hammering in the compressor at the restart. Liquid hammering can cause damage of the compressor.

Therefore, the annual replacement of the battery is recommended for safety reasons.

9.11.3 Inspection

Inspection work may be carried out by the operator in trimestrial intervals.

All equipment:
- Have a look for loose links, fasteners etc., tighten if necessary.
- Pay attention to unusual noise.
- Have a look for oil leakage on components and joints.
- Have a look at corrosion around piping of the refrigeration circuit, if necessary spraying again with acrylic varnish.

Air-cooled condenser, direct expansion evaporator:
Clean fin surface if necessary. Dirty fins reduce the transmission of heat which could result in unacceptable condensing / evaporation temperatures. Be careful not to damage the fins. Clean with compressed air or a vacuum cleaner.

Compressor:

Check oil sight glass in the crankcase (if mounted). Pay attention to unusual noise. To start the compressor manually, it has to proceed as described in **chapter 8.2.2** (**Manually starting the compressor via TRANE control**).

Coolant contents:

Check the inspection glass in the liquid line, to see whether the inspection glass is completely full. At maximum capacity, if bubbles appear in the inspection window, the contents are defective and must be rectified by a specialist. The appearance of bubbles under partial capacity can occur under certain performance windows and is not a sign of a prevailing fault with the refrigerant.

Condensate tray and outlet:

- Examine condensate outlet and tray for dirt and clean if necessary.
- Clean or rinse out condensate outlet from time to time.

9.12 Hygienic AHUs

The maintenance plan for TRANE AHUs you will find in **chapter 9.13** of the instruction manual. TRANE recommends maintenance in dependence on:

- VDMA 24186 part 1 and
- VDI 6022 part 1. In chapter 7 of VDI 6022 part 1, you can find detailed requests on operation and maintenance.

TRANE recommends as cleaning agent *Allrain* or *Multirain,* as disinfectant S*anosil* or *Sanirain of Hygan.*

9.13 Maintenance plan

The maintenance intervals specified in **Table 18** 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, Cl = Clean, M = Maintenance

Component	Action	Section	monthly	¼ year	½ year	year	Reference chapter
Housing	Ch / Cl	Housing inside and outside			X		
							9.2.1 Vibrations
Fan / motor	Ch	Corrosion check			X		
	Ch	Flexible connection			X		
	Ch	Vibration isolators			X		
	Ch	Protection grid			X		
	Ch	Water drain			X		
	Ch / Cl / M	Fan bearings		X			
	Ch / Cl / M	Fan bearings with lubricating	according to Table 14 (Lubrication intervals for fan bearings)				
	Ch / Cl / M	Motor, general			X		9.2.3 Motor
	Ch / M	Motor bearings		X			

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During operation of the AHU, an excessive vibration level can occur due an unfavorable air flow, accumulation of dirt and dust, missing 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 manufacturer's specifications, and the results must be recorded. The maximum vibration speed according to the manufacturer's specifications must be strictly observed. If the admissible vibration values are exceeded, it is absolutely necessary to identify the cause and take immediately appropriate measures.

Fan

	Ch / Cl / M	Motor bearings with lubricating nipples	according to Table 16 (Lubrication intervals for motor bearings (in month))			
	Ch	Check current consumption	X			
	Ch / Cl / M	Belt drive, general	X			9.2.4 V-belt drive
	Ch / M	Belt tension	first time after operation of 10 hours			
			X			
	M	Belt change	if necessary / at least after 2 years			
Filter	Ch / Cl / M	Panel filters	X			9.3.1 Panel filters
	Ch / Cl / M	Bag filters	X			9.3.2 Bag filters
	Cl / M	HEPA filters	X			9.3.3 HEPA filters
	C / M	Activated carbon filters	if saturation is reached			9.3.4 Activated carbon filters
Heat exchanger	Ch / Cl	Fins			X	9.4 Heat exchangers
	Ch	Frost protection			X	
	Ch / Cl	Drain pan			X	
	Ch / Cl	Droplet eliminator			X	
	Ch	Steam coil		X		9.4.1 Medium water / steam
Electric heater	Ch / Cl	E-heater		X		9.4.3 Electric Heater
		Check e-heater section for thermal damages after mains supply failure!				
Humidifier	Ch / M	Pump	X			9.5.1 General indications
	Ch / Cl	Decalcify / cleaning	if necessary			
	Ch	Drain pan	X			
	Ch / Cl / M	Spray humidifier	X			9.5.2 Spray humidifier
	Ch	Spray humidifier tubing	X			
	M	Flexible connector change	Substitute flexible connector every 5 years.			
	Ch / Cl / M	Evaporative humidifier	X			9.5.3 Evaporative humidifiers
	Ch	Bleed off settings / valves	X			
	Ch / Cl / M	High pressure humidifer	X			9.5.4 High pressure humidifiers
	Ch / Cl / M	Steam humidifier	X			9.5.5 Steam humidifiers
UV section	Ch / Cl	UV-C-lamps	X			9.6 UV section
Dampers	Ch / Cl	Dampers			X	9.7 Dampers
Silencer	Ch / Cl	Silencer			X	
Weather louver	Ch / Cl	Weather louver, grid and hood			X	
Energy recovery	Ch / Cl	Plate heat exchanger		X		9.10.1 Plate heat exchangers
	Ch / Cl	Heat wheel	X			9.10.2 Heat wheels
Refrigeration circuit	Ch	Leakage check	>= 500	>= 50	>= 5	9.11.1 Leakage checks
			Data in tons of CO_2-equivalent			
	Ch / Cl	Maintenance			X	9.11.2 Maintenance
	Ch	Inspection	X			9.11.3 Inspection
Control cabinet	M	Filter			X	9.1 Electrical connection, control cabinet
	Ch	Fan			X	
	Ch	Heater			X	
	Ch	Bolts, electrical connections			X	

Table 18: 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 221**. 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 220: Sound data information

11 AHUs in ATEX execution

11.1 Specific instructions for ATEX AHUs

The ignition hazard assessment was performed according to EN ISO 80079-36:2016 and EN 1127-1:2019-10. Applied protection: EN ISO 80079-37:2016-12 Protection by constructional safety "c".

Declaration of conformity in accordance to the EU - Directive 2014/34/EU
The manufacturer declares conformity to ATEX. The technical documentation in accordance with EU – Directive 2014/34/EU is deposited at TÜV South Germany. The declaration of conformity to ATEX applies only to the original delivery AHU and with proper repair and maintenance. When changes on the AHU are made, which are not agreed in writing, the declaration of conformity loses its validity.

The safety instructions in **chapter 2.1 (Indications for minimizing specific hazards)**, in particular the special safety instructions in **chapter 2.1.3 (ATEX AHUs)** must be observed. The instructions in **chapter 2.5 (Staff selection and qualification)** also apply accordingly.

The following conditions must prevail:
- On the intake side and in the vicinity of the device, the temperature shall not exceed -20 °C to +40 °C.
- An atmosphere with pressures from 0.8 bar to 1.1 bar shall be present in the environment of the AHU.

Based on the risk analysis, devices can basically be manufactured with the following definition (applies to inside and outside)
Gas: **II 2G Ex h IIB T4 Gb (inside / outside)**
Dust: **II 3D Ex h IIIB T170 Db (inside / outside)**

11.2 The ATEX type key

Example of designation:

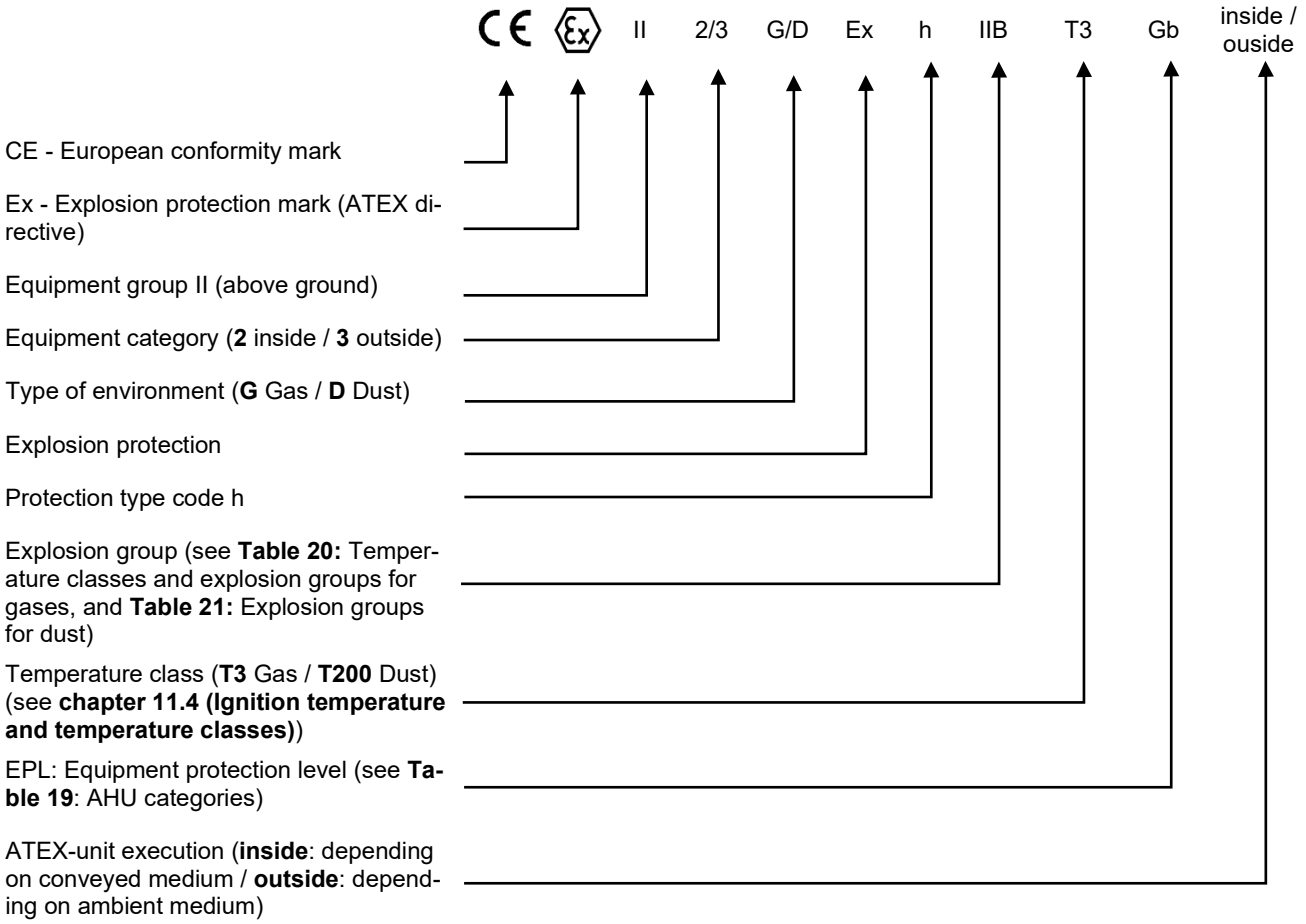

Figure 221: Example ATEX type key

Examples of applications:

II 3G Ex h IIB T3 Gc (inside)

The AHUs are designed for processing and transport of explosive atmospheres of Zone 2 but not for installation in Zone 2.
Equipment in this category ensures in normal operation, the required level of security.

II 2G Ex h IIB T3 Gb (inside)

The AHUs are designed for processing and transport of explosive atmospheres of zone 1 but not for installation in Zone 1.
The device-specific explosion protection measures of this category must provide the necessary security, even though lots of disturbances and error states, which usually must be considered, occur.

II 2G Ex h IIB T3 Gb (inside)
II 3G Ex h IIB T3 Gc (outside)

The AHUs are used for processing and transport of explosive atmospheres of zone 1 and for installation in Zone 2.
The device-specific explosion protection measures of this category (inside) must provide the necessary security at disturbances and error states, which usually must be considered.
The device-specific explosion protection measures of this category (outside) must provide the necessary security at disturbances and error states, which usually must be considered.

11.3 Supplementary notes on AHU design

Unit category	Designed for kind of explosive atmosphere	Usage in zone	Explanation	EPL: Equipment protection level
1 G	gas / air mixture or steam air mixture or fog	0	Explosive atmosphere permanently present	Ga: Safety in normal operation usual and rare operation disturbances / in case of 2 independent failures
2 G	gas / air mixture or steam air mixture or fog	1	Explosive atmosphere occasionally present	Gb: Safety during normal operation and usual operation disturbances
3 G	gas / air mixture or steam air mixture or fog	2	Explosive atmosphere rarely and only for a short time	Gc: Safety in normal operation
1 D	Dust air mixture	20	Explosive atmosphere permanently present	Da: Safety in normal operation usual and rare operation disturbances / in case of 2 independent failures
2 D	Dust air mixture	21	Explosive atmosphere occasionally present	Db: Safety during normal operation and usual operation disturbances
3 D	Dust air mixture	22	Explosive atmosphere rarely and only for a short time	Dc: Safety in normal operation

Table 19: AHU categories

11.4 Ignition temperature and temperature classes

The ignition temperature of a flammable gas, vapour or dust is the lowest temperature of a heated surface at which the ignition of the gas/air mixture or vapour/air mixture occurs. It is practically the lowest temperature value at which a hot surface can ignite the corresponding explosive atmosphere.

Temperatur classes at gases:

Temperature class gas	T1	T2	T3	T4	T5	T6
Max. surface temperature [°C] gas	**450**	**300**	**200**	**135**	**100**	**85**
Explosion group: **IIA**	Acetone Ammonia Benzene Acetic acid Ethane Ethyl acetate	Cyclohexanone Acetic acid-anhydride n-Butane n-butyl alcohol	Petrol Diesel Fuels Aviation fuels Fuel oils n-Hexane			

	Ethyl chloride Carbon mono-xide Methane Methanol Methyl chloride Naphtalin Phenol Propane Toluene					
Explosion group: **IIB**	City gas	Ethyl alcohol Ethylene	Hydrogen sulfide Ethyl glycol	Ethyl Ether		
Explosion group: **IIC**	Hydrogen	Acetylen				Carbon disulfide

Use of AHUs only possible in addition with other measures, e.g. special explosive atmosphere

Use of AHUs in appropriate design possible

Table 20: Temperature classes and explosion groups for gases

Maximum surface temperature for dust
For combustible dusts, no classification into temperature classes is made. The maximum surface temperature is given in absolute values in °C, e.g. T 200°C.

Dust Explosion groups
Electrical equipment of group III is further subdivided according to the features of the hazardous atmosphere for which it is intended, see **Table 21**. The hazard potential of dust rises in connection with the operation of electrical equipment from IIIA to IIIC. A device with IIIC classification is also suitable for group IIIA and IIIB.

IIIA	**Combustible fibres and lint** e.g.: textiles
IIIB	**Non-conductive dusts** e.g.: wood dust, flour dust
IIIC	**Conductive dusts** e.g.: metal dust, carbonaceous dust

Table 21: Explosion groups for dust

The maximum allowable surface temperature must always be lower than the ignition temperature of the explosive atmosphere. Safety factors are considered.

11.5 Additional instructions for foundation and erection, assembly, connection and commissioning, maintenance and repair

In addition to these specific specifications, the general instructions in this manual (in case of differing specifications, the ATEX-specific specifications must be observed in priority) and the instructions in the manuals of the component manufacturers (e.g. fan and motor manufacturers, etc.) must be observed. See also **chapter 1.4 (Documentation)** of this instruction manual.

The following measures are necessary to ensure the Equipment Protection Level (EPL):

- All conductive parts, components and connections (HE piping, siphon, ducts, ...) must be connected to a potential compensation. Before opening and closing such connections, e.g. when removing or replacing parts, bridging by means of connecting cables with an appropriate cross-section is necessary.
- For indoor AHUs all electrically conductive parts must be connected with a professional grounding measure (potential equalization). This prevents electrical potential differences, which can be a potential ignition source.
- Outdoor AHUs must be equipped with a professional lightning protection system and all metal parts must be connected to the ground conductors.
- It must be ensured that parts that are necessary to achieve the degree of protection, cannot be removed accidentally or unintentionally.
- Before the commissioning of the AHU, it must be ensured that all doors are closed and properly sealed so that there are no leaks. All doors are equipped with a closure device. The doors must be locked, and the key removed

During assembly and maintenance work it is important to take care that no tools or other objects remain in the AHU or duct system, to avoid malfunctions and sparks. – **RISK OF EXPLOSION!**

11.5.1 Foundation and erection

- The AHU must be connected to an external protective conductor system.
- In case of zone reduction between inside and outside of the AHU, an air exchange rate in the room of 6 times per hour must be ensured, for indoor installation.
- For outdoor installation, a free air flow along an axis is the precondition for zone freedom outside the AHU.

11.5.2 Assembly, connection and commissioning

11.5.2.1 Ensure the tightness of the AHU

To avoid zone entrainment during operation, the casing must comply with tightness class L1 according to EN 1886. Tightness class **L1** corresponds to a maximum air leakage rate of **0.15** l/ (s*m2) at a vacuum of 400 Pa.

Air leakage rate:
To comply with the required air leakage rate after the assembly of the AHU, the following points must be considered:
- The tightness depends very much on the onsite performed tightness, such as the tightening of the AHU separations / sections, cable glands, probes, etc.
- After completion of the work, the tightness must be checked appropriately and must be documented.

11.5.2.2 Motor:

- The connecting cables must comply with the specification EN 60079-14 (Section 9: Potentially explosive atmospheres, Part 14: Planning, selection and installation of electrical installations).
- Standard main switches must be assembled outside the hazardous area.

11.5.2.3 Fan section

- Belt: Use only electrically conductive, flame retardant and self-extinguishing belts (ISO 9563 or ISO 1813).
- **Use original spare parts.**

- The operating speed specified on the technical data must not be exceeded. The maximum permissible fan speed must not exceed 80%.

11.5.2.4 Air filters

- Only use electrostatic deductive filter.
- **Use original spare parts.**
- Each individual filter cell must be permanently and electrically conductively connected with a potential equalization cable to the inner casing of the AHU.
- To prevent the formation of an explosive atmosphere by stirring up of dust deposits, the equipment has protective systems and components designed to avoid deposits of combustible dusts as far as possible. Therefore, for all components corresponding service openings are provided.
- The AHU must be cleaned at regular intervals to prevent dust deposits.

11.5.2.5 Heat exchangers / steam humidifiers

The heat exchange medium temperature and the steam humidifier surface temperature specified in the technical data sheet must not be exceeded. In any case, these must be below the maximum admissible surface temperature or temperature class of the AHU. Otherwise, the specified temperature class and the EPL: Equipment protection level is no longer valid, the declaration of conformity loses its validity, and there is an acute **DANGER OF EXPLOSION!**

11.5.2.6 Field devices

- Onsite assembled field devices must comply the ATEX classification specified by TRANE.
- The electrical components (switches, lights, sensors, motors, etc.) must be approved for operation in explosive atmospheres and must be equipped with an appropriate marking.
- The cabling must meet the relevant standards.
- Appropriate potential equalization must be prepared.

11.5.3 Maintenance and repair

- In addition to the information in this chapter, maintenance and repair must be carried out according to **chapter 2.1.3 (ATEX AHUs)** and **chapter 9 (Maintenance)**. If the specifications differ, the ATEX-specific specifications in this chapter and in **chapter 2.1.3 (ATEX AHUs)** must be given priority.

12 Disassembly and disposal

12.1 Disassembly

At disassembly, the safety instructions of **chapter 2** (**Safety instructions**) must be considered. It also apply 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 the rivets.

Disassembly of the built-in parts:
- Secure slender 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. belt with hook or shekel with chain) and have to be secured until the components are safely fixed in the AHU – see **Figure 223**.
- Handling: securing with belt – see **Figure 224**.

Figure 222: Lifting with chain hoist

Figure 223: Securing with belt

12.2 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 done 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 CCE C		
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 manufacturer. Detailed information of the manufacturer can be found on the component.	
Electronic components		

Table 22: Information for disposal

Figure index

Table index

AH-SVX01H-GB_0321
Supersedes AH-SVX01G-GB_0719